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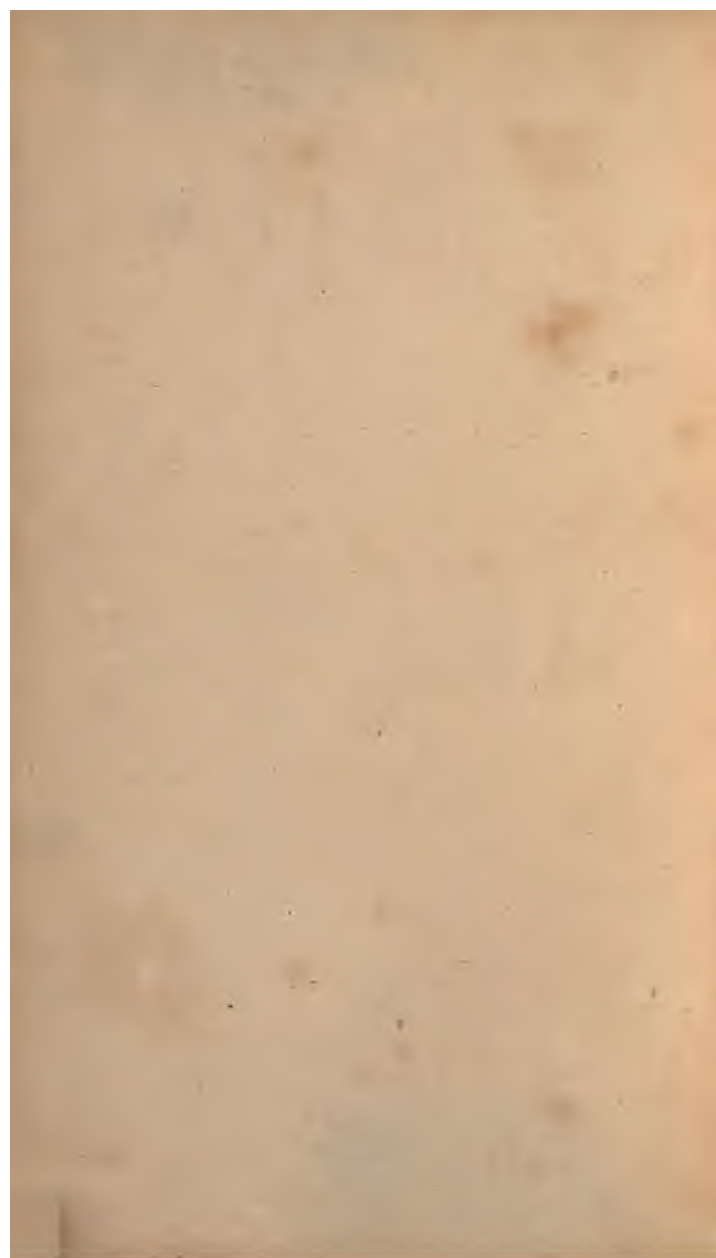




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A. Thompson del. et sculp.

1. Stag Beetle. 2. Night-shining Elater. 3. Blistering Lytta. 4. 5. Clow Worm.
6. *Oestrus Bovis*. 7. *Oestrus Equi*. 8. 9. 10. 11. Silk Worm.

ANIMAL BIOGRAPHY,

OR,

POPULAR ZOOLOGY;

ILLUSTRATED BY

AUTHENTIC ANECDOTES

OF

THE ECONOMY, HABITS OF LIFE, INSTINCTS, AND SAGACITY,

OF THE

Animal Creation.

BY THE

REV. W. BINGLEY, A. M. F. L. S.

IN FOUR VOLUMES.

SEVENTH EDITION.

VOL. IV.

INSECTS AND WORMS.

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ANIMAL BIOGRAPHY.

INSECTS*.

Coleopterous Insects†.

OF THE SCARABÆUS, OR BEETLE TRIBE‡.

THE larvæ or grubs of these insects have each six feet. In their general appearance they are not much unlike the caterpillars of some of the butterflies, having their bodies composed of rings, and being somewhat hairy. Most of them live entirely under the surface of the ground, and feed on the roots of plants, &c. Their *pupa*, or *chrysalis*, generally lies dormant in the earth till the perfect insect bursts out.

Beetles inhabit and feed in various situations. Some are found in the dung of animals, or in the earth immediately under the dung. Others live on the leaves of trees; and others on flowers.

* For an account of the Insects in general, see vol. i. p. 38.

† The insects of the Linnean order *Coleoptera* have crustaceous elytra or wing-cases, which shut together and form a longitudinal suture down the back.

‡ The antennæ of the Beetles have a clavate or enlarged extremity, which is divided into lamellæ or leaves. To the mouth there are four palpæ or feelers. The feet have each five joints; and the shanks of the fore-legs are generally toothed.

THE BULL-COMBER*, CLOCK-BEETLE†, AND SPRING
BEETLE‡.

These insects are all nourished, both in their larva and perfect state, in the dung of animals, which they are able to discover by their acute faculty of smell, or otherwise, at an immense distance. Under these substances they dig, in the earth, cylindrical holes, of considerable depth, in which they deposit their eggs.

They usually fly in the evening, towards the end of twilight. The droning noise produced by their wings, at that time, is often heard, particularly during the summer season. When touched, these insects counterfeited death; but they do not contract their legs, in the manner of the *Dermestes*, and some other Beetles: they stretch them out, so as to give the appearance of stiffness and rigidity, as though the animals had been some time dead.

All these insects are subject to be infested by a species of *acarus*, or tick, and sometimes in such numbers that they are scarcely able to walk in consequence of

* DESCRIPTION: The thorax of this Beetle has three horns, of which the middle one is the smallest, and the lateral ones are nearly as long as the head. The elytra or wing-cases are striated. The whole insect is of a shining black colour.

SYNONYMS. *Scarabæus typhæus*. *Linnaeus*. *Fabricius*.—*Géotrupe phalangiste*. *Latreille*.

† DESCRIPTION. The thorax and head are unarmed. The shield is rhombic; and the crown somewhat prominent. The body is black, and the elytra are striated.

SYNONYMS. *Scarabæus stercorarius*. *Linnaeus*.—*Géotrupe stercoraire*. *Latreille*.—*Le Grand Pilulaire*. *Geoff*.

‡ DESCRIPTION. The thorax and head are unarmed. The elytra are without streaks or punctures. The shield is rhombic; and the crown a little prominent. The general colour is a brilliant black.

SYNONYMS. *Scarabæus vernalis*. *Linn*.—*Géotrupe printanier*. *Latreille*.—*Le Petit Pilulaire*. *Geoffroy*.

these crowding closely round the joints of the legs and thighs. A German writer states, that the females of that country used formerly to employ the thighs of some of the most brilliant of these Beetles, in the ornamental parts of their head-dress.

THE COCK-CHAFER *.

The eggs of the Cock-chaffer are deposited in the ground by the parent insect, whose fore-legs are very short, and are well calculated for burrowing. From each of these eggs proceeds, after a short time, a whitish worm with six legs, a red head, and strong claws, and about an inch and a half long, which is destined to live in the earth under that form for four years, and there to undergo various changes of its skin, until it assumes its chrysalid form. It subsists, during its subterraneous abode, on the roots of trees and plants, committing ravages often of the most deplorable nature. These creatures, sometimes in immense numbers, work between the turf and the soil in the richest meadows, devouring the roots of the grass to such a degree, that the turf rises, and will roll up with almost as much ease as if it had been cut with a turfing-knife: and underneath, the soil appears turned into a soft mould for more than an inch in depth, like the bed of a garden. In this the grubs lie, on their backs, in a curved position, the head and tail uppermost, and the rest of the body buried in the mould. Mr. Arderon, of Norwich, mentions his having seen a whole field of fine flourishing grass become, in a few weeks,

* See Plate xix. Fig. 1, 2.

SYNONYMS. *Scarabæus Melolontha*. Linn.—*Melolontha vulgaris*. *Fabricius*.—Brown Tree Beetle, Blind Beetle, Chaffer, Jack-horner, Jeffry-cock, May-bug, Tree Beetle, Brown Clock, Dor, in various parts of England. Millers, from their powdery white colour. The Grub is called the Connaught Worm in Ireland.

withered, dry, and as brittle as hay, by these grubs devouring the roots.

The larvæ, as I have said, continue four years in the ground; and when, at the end of this period, they are about to undergo their change, they dig deep into the earth, sometimes five or six feet, and there spin a smooth case, in which they change into a *pupa* or *chrysalis*. They remain under this form all the winter, until the month of February, when they become perfect beetles, but with their bodies quite soft and white. In May the parts are hardened, and they then come forth out of the earth. This accounts for our often finding the perfect insects in the ground.

Cock-chafers fly in the evening towards sunset, and particularly about places where there are trees. They eat the leaves of the sycamore, the lime, the beech, the willow, and those of all kinds of fruit-trees. In its winged state this insect exhibits not less voracity on the leaves of trees, than it before did in its grub state in the earth; for, such is the avidity with which it devours its food, and so immense are sometimes the numbers, that, in particular districts, they have become an oppressive scourge, which has produced much calamity among the people.

In the year 1688, the Cock-chafers appeared on the hedges and trees of the south-west coast of the county of Galway, in clusters of thousands, clinging to each other's backs, in the manner of bees when they swarm. During the day they continued quiet, but towards sunset the whole were in motion; and the humming noise of their wings sounded like distant drums. Their numbers were so great, that, for the space of two or three square miles, they entirely darkened the air. Persons travelling on the roads, or who were abroad in the fields, found it difficult to make their way home, as the insects were continually beating against their faces, and occasioned great pain. In a very short time, the leaves of all the trees, for several miles round, were destroyed, leaving the whole country,

though it was near midsummer, as naked and desolate as it would have been in the middle of winter. The noise which these enormous swarms made in seizing and devouring the leaves, was so loud as to have been compared to the distant sawing of timber. Swine and poultry destroyed them in vast numbers. These waited under the trees for the clusters dropping, and devoured such swarms as to become fat upon them alone. Even the native Irish, from the insects having eaten up the whole produce of the ground, adopted a mode of cooking them, and used them as food. Towards the end of summer they disappeared so suddenly, that, in a few days, there was not a single one left.

About sixty years ago a farm near Norwich was so infested with Cock-chafers, that the farmer and his servants affirmed that they gathered eighty bushels of them; and the grubs had done so much injury, that the court of that city, in compassion to the poor man's misfortune, allowed him 25*L*.

Mouffiet informs us, that in the month of February, 1574, there were such multitudes of Chafers in the western parts of England, that those which fell into the river Severn completely clogged the water-wheels of the mills.

Rooks and gulls devour immense numbers of the grubs of this destructive insect, by which they render a most essential service to mankind, and great care ought to be taken to cherish and protect them. The chief employment of rooks, during nearly three months in the spring of the year, is to search for insects of this sort as food; and the havock that a numerous flock makes among them must be very great.

A gentleman, having found a nest of five young jays, remarked that each of these birds, while yet very young, consumed at least fifteen full-sized grubs of the Chafer in a day; and averaging their sizes, it may be said that each consumed twenty: this for the five makes a hundred; and if we suppose the parents to devour between them the same number, it appears that

the whole family consumed about two hundred every day. These, in three months, would amount to twenty thousand. But as the grub continues in the same state for four years, this single pair, with their family alone, without reckoning their descendants after the first year, would destroy as many as eighty thousand grubs. Now, supposing that forty thousand of these may be females, and that each female lays, as is the case, about two hundred eggs, it will appear that no fewer than *eight millions* of grubs have been destroyed, or at least prevented from being hatched, by this single family of jays.

It is true, that in these labours of the rooks, jays, and some other birds, they sometimes do mischief to man; and yet there can be little doubt, that the damage they thus commit is amply repaid by the benefits that result from these their unceasing exertions.

Some farmers plough the ground in order to expose the grubs to the birds; and others take the pains to dig deeper, wherever the rooks point them out by their attempts to reach them. When the insects are in their winged state, to shake the trees at noon, during the time that they are all either asleep or in a state of inactive stupor, and to gather or sweep them up from the ground, seems the most eligible method. One person has been known to kill in a day, by this method, above a thousand: by which, though in so short a space of time, at a fair calculation, he prevented no fewer than a hundred thousand eggs from being laid.

The dead bodies of these insects afford a very acceptable food to ducks, turkeys, and other poultry. Swine, as already observed, greedily devour them; cats catch and eat them with great avidity.

A person near Bloise, in France, employed, in the year 1785, a number of children and poor persons, to destroy the Cock-chafers, at the rate of two liards a hundred. In a few days fourteen thousand were brought to him. Thus, for the moderate sum of about seven shillings and eightpence sterling, he destroyed,

according to his calculation, nearly a *million and a half* of the grubs; which, had they been allowed to be hatched, might, in the course of four years, have done damage to the amount of many thousand pounds.

THE ROSE-CHAFER*.

There are scarcely any of the English Chafers more beautiful than this. The upper parts of the female are of a shining green colour, marked transversely on the wing-cases with a few short white or yellowish lines. The male is of a burnished copper-colour, with a greenish cast. These insects are somewhat more than an inch in length. They are found on flowers, particularly on those of the rose and peony.

The grubs that produce this beetle feed underground, generally at the roots of trees, and never appear on the surface unless disturbed by digging, or some other accident. They are thought to be injurious to the gardener, by devouring the roots of his plants and trees. The female deposits her eggs in the middle of June. For this purpose she burrows into soft, light ground, hollowing out and forming for them a proper receptacle. When the operation is over, she returns to the surface and flies off, but seldom lives more than two months afterwards. The grubs are produced in about fourteen days, and immediately seek out for food, which the parent always takes care to have near the place where she lays her eggs. As soon as they have attained sufficient strength, the young grubs separate, each burrowing in a different direction, in search of roots. They remain four years in this state, annually changing their skin till they become of full growth, when they are of a cream-colour, with brown head and feet. During winter they eat but little, if at all, and

* SYNONYMS. *Scarabæus auratus*. *Linnaeus*.—*Cetonia aurata*. *Fabricius*.—Rose May Chafer, Green Beetle, and Brass Beetle, in some parts of England.

they retire so deeply into the ground as to avoid the effects of the frost.

About the month of March, at the end of the fourth year, the grub forms a case of earth, about the size of a walnut, somewhere near the surface, within which it changes into a chrysalis. In this state it remains till the beginning of May, when it bursts out a perfect Chafer. This is at first of a light green colour, and very tender; but it soon acquires its proper hardness and strength.

When the insect is touched it emits a fetid moisture, which, no doubt, is a mode of defence against the attacks of its enemies.

THE PILL CHAFER*.

In its habits of life the Pill Chafer is one of the most remarkable of the Beetle tribe. It comes forth in April, and is to be seen abroad until about September, when it disappears. Its almost constant employment, in which indeed it is indefatigable, is in the different operations necessary to continue its species. It constructs a proper nidus for its eggs, by forming round pellets of dung, in the middle of each of which it deposits an egg. These, in September, the insects convey to the depth of about three feet into the ground. Here they remain till the approach of spring, when the grubs burst their shells, and find their way to the surface of the earth.

"I have attentively admired their industry, and their

* DESCRIPTION. This insect is somewhat more than an inch in length, and of a dusky black colour, sometimes with a greenish hue above, and underneath of a very brilliant blue or green. The wing-cases and thorax are very smooth; the former are marked with several longitudinal streaks, and the latter are round, margined, and have a slight groove in the middle.

This insect is found both in Europe and America.

SYNONYMS. *Scarabeus pilularius*. *Lin.*—*Ateuchus pilularius*. *Fabricius*.—Tumble-dung Beetle. *Brickell*.

mutually assisting of each other (says Catesby) in rolling these globular balls from the place where they made them, to that of their interment, which is usually at the distance of some yards, more or less. This they perform breech foremost, by raising their hind parts, and forcing along the ball with their hind feet. Two or three of them are sometimes engaged in trundling one ball, which, from meeting with impediments, on account of the unevenness of the ground, is sometimes deserted by them. It is, however, attempted by others with success, unless it happen to roll into some deep hollow or chink, where they are constrained to leave it; but they continue their work by rolling off the next ball that comes in their way. None of them seem to know their own balls, but an equal care for the whole appears to affect all the community. They form these pellets while the dung remains moist; and leave them to harden in the sun before they attempt to roll them. In their moving of them from place to place, both they and the balls may frequently be seen tumbling about over the little eminences that are in their way. They are not, however, easily discouraged; and, by repeating their attempts, usually surmount the difficulties."

Catesby says also that these insects find out their subsistence by the excellence of their *noses*, which direct them in their flight to newly-fallen dung, on which they immediately go to work, tempering it with a proper mixture of earth. So intent are they always upon their employment, that, though handled or otherwise interrupted, they are not to be deterred, but immediately on being freed, persist in their work without any apprehension of danger.

They are so strong and active, as to move about, with the greatest ease, things that are many times their own weight. Dr. Brickell was supping one evening in a planter's house of North Carolina, when two of these insects were conveyed, without his knowledge, under the candlesticks. A few blows were struck on the table, and to his great surprise the candlesticks be-

gan to move about, apparently without any agency; and his surprise was not much lessened, when, on taking one of them up, he discovered that it was only a Chafer that moved it.

Professor Thunberg and Mr. Brown both mention the operations of a species of Chafer in the different parts of Africa that they visited, which agree in every respect with those of the present species. We have also one in our own country, *Scarabæus lunaris*, whose manners are nearly similar.

Aristophanes, in his *Eupnm*, has introduced one of the Dung-chafers, on which a character in the play mounts up to Jupiter, to petition for peace.

OF THE LUCANUS OR STAG-BEETLE TRIBE.

The antennæ of the Stag-beetles have a club-shaped extremity, divided into short, comb-like leaves. The jaws are toothed, and extend so far beyond the head, as to resemble horns. Under the lip there are two palpi or feelers, so thickly covered with hair, as to appear like tufts.

Stag-beetles are chiefly found in rotten and half-decayed wood, and under the bark of trees.

THE GREAT STAG-BEETLE*.

In some parts of the south of England, these insects are very common in oak and willow trees. In the

* See Plate xviii. Fig. 1.

DESCRIPTION. This is the largest kind of insect that is found in Great Britain. It sometimes measures nearly three inches, from the points of its jaws to the extremity of the abdomen. Its colour is dark brown, except the jaws, which are sometimes as red as coral, and give to it a very beautiful appearance: by these, which resemble in form the horns of a stag, it is readily distinguished from all other insects.

SYNONYMS. *Lucanus cervus*. *Linnaeus*.—*Lucane* Cerf-volant. *Latreille*.—*Le grand Cerf-volant*, in France.

stumps or about the branches of these they remain concealed during the day; flying abroad and feeding on the leaves only in the evening. The month of July is the time during which they are principally seen. The males, in particular, have great strength in their mandibles or jaws. With these they are able to pinch very severely. Linnæus informs us, that they feed on the liquor that oozes from the trunks or branches of trees; and it has been conjectured that the jaws are used either in obtaining their food, or in fixing themselves firmly to the spot while they eat. It is said that Stag-beetles may be kept alive for a considerable time, if supplied with the fresh leaves of oak or willow, or with sweetened water.

In Germany there is a popular notion, that these insects are sometimes known, by means of their jaws, to carry burning coals into the houses; and that, in consequence of this, dreadful fires have been occasioned.

It is a singular circumstance respecting these insects, that I have frequently found several of their heads near together, and alive, while the trunks and abdomens were nowhere to be seen: sometimes only the abdomens were gone, and the heads and trunks were left. How this takes place, I never could discover. An intimate and intelligent friend of mine supposes, however, that it must have been in consequence of severe battles which at times take place among these, the fiercest of the insect tribes: but their mouths not seeming formed for animal food, he is at a loss to conjecture what becomes of the abdomens. They do not fly until most of the birds have retired to rest; and indeed, if we were to suppose that any of these devoured them, it would be difficult to say why the heads or trunks should alone be rejected.

The females deposit their eggs in decayed or worm-eaten trees. The larvæ, which are round and whitish, with rust-coloured head and legs, are nourished under the bark. In this state they pass six years. When about to undergo their change into a chrysalis, each

insect forms a hard and solid ball, of the form of an egg, and sometimes as large as the hand. When the perfect insect issues forth, it is at first quite soft. Its parts, however, soon harden, and in a little while it is able to fly away.

OF THE DERMESTES TRIBE*.

In their perfect state, these insects are generally extremely timid. The moment they are threatened with danger, they stop in their course, draw up their antennæ and feet, and continue in a feigned state of death, until the object of their fear is removed.

The larvæ or maggots, subsist chiefly on the bodies of dead animals, dried skins, the bark of trees, and old wood. Some of them are very destructive to books and furniture.

THE BACON DERMESTES†.

These insects are produced from maggots which are bred and nourished in bacon, or in other animal substances. To collections of dried and preserved animals, they are sometimes particularly injurious. They change their skins several times. These skins continue stretched out, as if blown up, and are in appearance like the little animals which cast them.

* The antennæ are club-shaped; the club is perfoliate. The thorax is convex, and slightly margined. The head is inflected under the thorax.

† DESCRIPTION. The perfect insect is black, having the elytra or shells cinereous on the upper part. The larvæ are elongated, the body diminishing insensibly before and behind, and terminating in a truncated cone. The skin is hard and leathery, of a brown colour above, and covered with long hair. The *pupa* or *chrysalis* is white, with the eyes and some transverse rays on the back yellowish.

SYNONYMS. *Dermestes lardarius*. *Lin.*—Le Dermeste du Lard. *Latreille*.

In order to undergo their transformations, the larvæ search out some convenient retreat; and generally find one among the wreck of the substances which they have gnawed. They do not continue in their chrysalid form more than about three weeks or a month.

OF THE PTINUS OR BORER TRIBE*.

In a larva state, these insects are chiefly found in the trunks of decayed trees, and in old wood, where they make holes as round as though they had been formed with a gimlet. They are nearly allied to the Dermestes, but differ from those insects in the form of their antennæ, mandibles, and legs.

In the spring of the year, says Olivier, we see these insects issuing from wood where the *pupæ* have been enclosed; and, attracted by the rays of the sun, run along upon the window-frames, beams, or wainscot. Like the Dermestes, they feign themselves to be dead when touched: burying their head under the thorax, drawing in the legs, and concealing entirely their antennæ between the head and upper borders of the thorax, they present only the appearance of an inanimate substance.

The devastations which their larvæ commit are very great. Old moveables of wood, worm-eaten, and full of cylindrical holes, indicate, at the same time, the work and the habitations of these insects. By means of two strong and powerful jaws, they gnaw the wood on which they feed; and this, after passing through their bodies, is deposited in small grains of very fine powder, which fills up the holes behind them, as the little creatures pass onward. They increase their dwellings as

* These insects have antennæ that are nearly of an equal thickness throughout; the last joints, however, in most of the species, are somewhat larger than the rest. The thorax is nearly round, unmarginated, and contains the head.

they themselves increase in size ; and when they have attained their full dimensions, they weave a nidus, of a kind of silk issuing from their body, in the bottom of their hole. In this they change to a pupa state, and afterwards to perfect insects.

There are numerous species, several of which are found in England. It will not be necessary for me to speak of more than one.

THE DEATH-WATCH PTINUS*.

Notwithstanding its smallness, this creature is often the cause of serious alarm among the superstitious, from the noise which it makes, at a certain season of the year, resembling the ticking of a watch. From this it has its name; for, whenever this faculty is exerted, it is esteemed portentive of death to some one of the family in the house where it is heard. The philosopher and the naturalist may smile at a notion thus absurd; yet Sir Thomas Brown has remarked, with great earnestness, that the man, "who could eradicate this error from the minds of the people, would save from many a cold sweat the meticulous heads of nurses and grandmothers."

The wether's bell
Before the drooping flock toll'd forth her knell,
The solemn Death-watch click'd the hour she died.

It is generally in the advanced state of spring, that these insects commence their noise. This is nothing more than a call or signal, by which they are mutually attracted to each other; and it may be considered as

* DESCRIPTION. The Death-watch is a dusky and somewhat hairy insect, with irregular brownish spots, about a quarter of an inch in length.

SYNONYMS. *Ptinus tessellatus*. *Lin.*—*Anobium tessellatum*. *Fabricius*.—*Ptinus fatidicus*. *Shaw's Nat. M.*

analogous to the call of birds. It is not occasioned by the voice, but by the insect's beating on any hard substance with the shield or fore-part of its head. The general number of successive distinct strokes, is from seven to nine or eleven. These are given in tolerably quick succession, and are repeated at uncertain intervals; and in old houses, where the insects are numerous, they may be heard during warm weather almost every hour in the day. The noise exactly resembles that made by beating with a nail upon the table.

This insect, from its obscure grayish brown colour, nearly resembling that of decayed wood, is difficult to discover: it is consequently not always easy to say from what exact spot the sound proceeds. Mr. Stackhouse observed carefully the manner of its beating. He says, the insect raises itself on its hind legs, and, with the body somewhat inclined, beats its head with great force and agility against the place on which it stands. One of them, on a sedge-bottomed chair, exerted so much force, that its strokes were impressed and visible in the exterior coat of the sedge, for a space equal to that of a silver penny. Mr. Stackhouse took this insect and put it into a box. On the following day he opened the box, and set it in the sun. The insect seemed very brisk, and crept about with great activity on the bits of sedge and rotten wood, till at last, getting to the end of the pieces, it extended its wings, and was about to take flight. He then shut down the lid, when it withdrew them, and remained quiet. He kept it by him about a fortnight.

The idea of taming this little animal may appear absurd: it has, however, been so much familiarized, as to be made to beat occasionally. On taking it out of its confinement, and beating with the nail or the point of a pen on a table or board, it will answer the beats very readily, and will even continue to repeat its efforts as long as it is required.

Dr. Derham kept a male and female together in a box for about three weeks; and, by imitating their

noise, he made them beat whenever he pleased. At the end of this time one of them died; and soon afterwards the other gnawed its way out and escaped.

This insect, which is the real Death-watch of the vulgar, emphatically so called, must not be confounded with a wingless insect, not much unlike a louse, which makes a ticking noise like a watch, but which, instead of beating at intervals, continues its noise for a considerable length of time without intermission. The latter belongs to a tribe very different from this; it is the *Termes Pulsatorium* of Linnæus, and will be hereafter described. ●

OF THE SILPHÆ, OR CARRION BEETLES.

These insects are chiefly found, both in a perfect and larvæ state, in the half-decayed and putrid bodies of animals. Their antennæ are clavate, and the club is perfoliate. The elytra or wing-cases are margined; and the head is prominent. The thorax is somewhat flattened, and also margined.

THE BURYING SYLPH*.

The best account that I have seen of the habits and economy of these interesting insects, is that written by M. Gleditsch, a well-known writer on natural history. This gentleman had, at different times, observed, that moles which had been left upon the ground after they had been killed, very unaccountably disappeared. He therefore was determined, if possible, to ascertain

* See Plate xix. Fig. 3.

DESCRIPTION. The body and the wing-cases of this insect are black; the latter with two ferruginous sinuate bands. The clubs of the antennæ are red.

It is found not only in England, but in almost every part of Europe.

SYNONYMS. *Silpha vespillo*. Linn.—*Scarabæus silphoides*? Pallas *1c. ins. Russ. p. 11. t. A. fig. 11.*—Le Fossoyeur, in France.

by experiment, what could be the cause of this singular occurrence.

On the twenty-fifth of May, he accordingly obtained a dead mole, which he placed on the moist, soft earth of his garden, and in two days he found it sunk to the depth of four fingers' breadth into the earth: it was in the same position in which he had placed it, and its grave corresponded exactly with the length and breadth of its body. The day following, this grave was half filled up; and he cautiously drew out the mole, (which exhaled a horrible stench,) and found, directly under it, little holes, in which were four Beetles of the present species. Discovering at this time, nothing but these Beetles, he put them into the hollow, and they quickly hid themselves among the earth. He then replaced the mole as he found it, and, having spread a little soft earth over it, left it without looking at it again for the space of six days. On the twelfth of June he again took up the same carcass, which he found in the highest state of corruption, swarming with small, thick, whitish worms, that appeared to be the family of the Beetles. These circumstances induced him to suppose that it was the Beetles that had thus buried the mole, and that they had done this for the sake of lodging in it their offspring.

Mr. G. then took a glass vessel, and half filled it with moist earth; into this he put the four Beetles with their young-ones, and they immediately concealed themselves. This glass, covered with a cloth, was placed on the open ground, and in the course of fifty days, the four Beetles interred the bodies of *four* frogs, *three* small birds, *two* grasshoppers, and *one* mole, besides the entrails of a fish, and two small pieces of the lungs of an ox.

Of the mode in which they performed this very singular operation, the following is an account: A linnet that had been dead six hours was placed in the middle of the cucurbit: in a few moments the Beetles quitted their holes, and traversed the body. After a few hours, one pair of the Beetles only was seen about the bird:

the largest of these was suspected to be the female. They began their work by hollowing out the earth from under the bird. They arranged a cavity the size of the bird, by pushing all around the body the earth which they removed. To succeed in these efforts, they leaned themselves strongly upon their collars, and, bending down their heads, forced out the earth around the bird like a kind of rampart. The work being finished, and the bird having fallen into the hollow, they covered it, and thus closed the grave.

It appeared as if the bird moved alternately its head, its tail, its wings, or feet. Every time that any of these movements were observed, the efforts that the Beetles made to draw the body into the grave, which was now nearly completed, might be remarked : in effecting this, they jointly drew it by its feathers below. This operation lasted full two hours, when the smallest or male Beetle, drove away the female from the grave, and would not allow her to return, forcing her to enter the hole as often as she attempted to come out of it.

This Beetle continued the work alone for at least five hours; and it was truly astonishing to observe the great quantity of earth which he removed in that time : but the surprise of Mr. G. was much augmented, when he saw the little animal, stiffening its collar, and exerting all its strength, lift up the bird, make it change its place, turn, and, in some measure, arrange it in the grave that it had prepared ; which was so spacious, and so far cleared, that he could perceive exactly under the bird, all the movements and all the actions of the Beetle.

From time to time, the Beetle, coming out of its hole, mounted upon the bird, and appeared to tread it down ; then, returning to the charge, it drew the bird more and more into the earth, till it was sunk to a considerable depth. The Beetle, in consequence of this uninterrupted labour, appeared to be tired : leaning its head upon the earth, it continued in that position nearly an hour, without motion ; and it then retired completely underground.

Early in the morning the body was drawn entirely underground, to the depth of two fingers' breadth, in the same position that it had when laid on the earth; so that this little corpse seemed as if it were laid out on a bier, with a small mount or rampart all round, for the purpose of covering it. In the evening the bird was sunk about half a finger's breadth deeper in the earth; and the operation was continued for nearly two days more, when the work obtained its final completion.

A single Beetle was put into the glass cucurbit, with the body of a mole, and covered, as before, with a fine linen cloth. About seven o'clock in the morning, the Beetle had drawn the head of the mole below; and, in pushing the earth backward, had formed a tolerably high rampart around it. The interment was completed in this instance, by four o'clock in the afternoon, a space of time so short, that one could scarcely have imagined the operation possible, by so small a creature, without any assistance, and considering that the body of the mole must have exceeded the insect in bulk and weight at least thirty times.

While engaged in these experiments, a friend, who wished to dry a toad in the shade, fixed it to a stick which he stuck into the ground. When it began to putrefy, the Beetles, allured by the smell, having loosened the end of the stick that was fixed in the earth, brought it to the ground, and they then interred both the toad and the stick.

The interment of these animals, which generally takes place from about the middle of April to the end of October, has been sufficiently proved to be not merely for food, but as a proper nidus for the eggs of the insects, and to nourish the young family of grubs that proceeds from them. If they wanted them for food only, they would no doubt consume them above ground; but in the continuation of the species, it is necessary to have them below, since, otherwise, foxes, ravens, kites, and other carnivorous animals, would

seize on the bodies, and, along with them, would swallow the grubs of the Beetles.

OF THE COCCINELLA OR LADY-BUG TRIBE.

The principal food of these insects consists of aphides or plant-lice, by destroying which, in immense numbers, they render a most important service to mankind.

Their antennæ are club-shaped, and the club is solid. The thorax and elytra are margined. The body is hemispherical, and the abdomen flat. The larvæ or grubs of some of the species, have their bodies covered with scaly plates; others have hairs on the upper parts of the body, and on the sides; and there are others still different.

THE SEVEN-SPOTTED* AND TWO-SPOTTED LADY-BUG†.

Few insects are either more common or better known than these. They are usually found on plants, where they repose with the legs concealed under their body, and their antennæ beneath the head. In winter they hide themselves and become torpid, and they again appear abroad in the spring.

The females deposit their eggs on such plants as abound with aphides or plant-lice. The larvæ have each six feet, and a conical body divided into twelve

* DESCRIPTION. The wing-cases are red, and marked with seven black dots.

SYNONYMS. *Coccinella septem-punctata*. Linn.—La Coccinelle sept points. Tigny.—Lady Cow, Lady Bird, and Cow Lady, in several parts of England.

† DESCRIPTION. The wing-cases are red, and marked with two black dots.

SYNONYMS. *Coccinella bi-punctata*. Linn.—La Coccinelle bipoctué. Tigny.

rings. At the extremity of the posterior ring, there is a kind of fleshy teat, by which they are able to adhere to solid bodies, and firmly to support themselves while employed in seizing and devouring their food. They are so extremely voracious, that when other food is scarce, they will sometimes eat even their own species.

In order to change into the *pupa* state, they attach themselves by their fleshy feet, to the leaves or branches of trees. Here they drop a small quantity of glutinous liquor, which fixes them to the spot, and, in a position contrary to that of the plane to which they adhere. Little by little their body contracts, and at the end of two or three days they undergo their transformation. In freeing themselves from their skin, they make it pass towards the hinder part of their body, where it continues like a little pellet.

The *pupæ* are beautifully spotted with black and other colours. The only motion observable in them, is that of alternately elevating and depressing their body, particularly if touched. They finally quit their envelope in about six days after this last change. When they first come into the world as perfect insects, their wing-cases are of a yellowish white colour, soft and flexible. These soon harden by their contact with the external air; and shortly afterwards assume their proper spots and colours.

Lady Bugs have in France the name of *Bête à Dieu*, *Vache-à-Dieu*, and *Bête de la Vierge*.

OF THE CURCULIO OR WEEVIL TRIBE*.

The *larvæ* of the Weevils, like those of other coleopterous insects, have each six legs and a scaly head.

* The Weevils have clavate antennæ seated on the snout, which is horny and prominent. They have also four thread-shaped feelers.

They have a resemblance to oblong soft worms. Some of them infest granaries, where, from their numbers and voracity, they often commit great ravages among the corn: some live in fruits, the insides of artichokes, thistles, and other plants; and others devour the leaves of trees and vegetables.

One division of the Weevils feed on trees and shrubs, inserting their beaks into the tender branches, and by this means extracting their juices. The *Curculio alliarie* has been observed with its beak plunged into the twig of a crab-tree, as far as the place whence the antennæ arise. Another division feed solely on plants. Others live on grain, wood, and on some of the species of fungi; and a few under the surface of the earth.

THE CORN WEEVIL*.

The Corn Weevil is well known to most farmers, from the devastation that it makes in their granaries. The parent insect lays its eggs in grains of corn, probably one in each grain. Here the larvæ, on being hatched, continue for some time to live, and it is very difficult to discover them, as they lie concealed within. They increase their size, and with it their dwelling, at the expense of the interior or farinaceous parts of the grain on which they feed. Corn-lofts are often laid waste by these grubs, whose numbers are sometimes so great, as to devour nearly the whole of their contents. When the grub has attained its full size, it still remains within the grain, hidden under the empty husk. There, being transformed, it becomes a chrysa-

* DESCRIPTION. This insect is of a black-brown colour, and scarcely more than the tenth of an inch in length. Its snout is long and small; and the thorax is punctured, and nearly as long as the abdomen.

SYNONYMS. *Curculio granarius*. Linn.—*Calendra granaria*. Fabricius.—Weevil, in many parts of the country.

lis; and, when it has attained its perfect state, it forces its way out.

It is no easy matter to discover by the eye the grains that are thus attacked, for, in external appearance, they are still large and full. If, however, they be thrown into water, their lightness soon detects them.

To rid a granary of these destructive insects, it has been recommended to farmers to spread their corn in the sun, when the Weevils will creep out of their holes; and, by often stirring the corn while in this situation, it is supposed they may be completely expelled. It is also said that they may be destroyed by strewing boughs of elder, or branches of henbane, among the corn. In a late Paris paper, a gentleman says, that about the month of June, when his granaries and barns, that had been much infested by Weevils, were all empty, he caused a number of the hills of the large ants to be collected in bags, and placed in different parts about them. The ants immediately attacked the Weevils that were on the walls and other parts, and destroyed them so completely, that in a very short time not a single Weevil was to be seen; and since that period, he says, they never appeared on his premises.

THE NUT WEEVIL*.

This insect is produced from the white grub that we often find living in the interior of the hazel nut. The history of its changes and growth is singular and interesting; and exhibits an extraordinary instance of

* DESCRIPTION. The Nut-weevil is about a quarter of an inch in length, and of a gray-brown colour. The body is somewhat of an oval shape, having the posterior extremity not rounded, but ending in a point. The beak, or rostrum, is red, and as long as the body.

SYNONYMS. *Curculio nucum*. Linn.—*Phynchænus nucum*. Fabricius.—Nut Beetle. Harris.

the care that has been taken to promote the comfort and convenience of even these diminutive tribes.

The caterpillar or grub proceeds from a very small brown egg, which the parent deposits in the outside of the nut, at a time when it is very soft and tender. When the heat of the season has perfected the little grub, it eats its way out of the egg, and through the shell, into the nut. His chief food now is the coat of the nut, or that part which afterwards hardens into the shell; and he continues to feed on this, and the interior pulp, until such time as the one becomes too hard, and the other too dry for his sustenance. He then begins on the kernel, which is now grown so large as to afford him support: and it is to be remarked, that this seems a most providential instinct; for, had he commenced his attacks on the kernel when it was small, he would have destroyed that on which all his future welfare depended, and that which is the principal food allotted to him by nature when in a larva state. While feeding, he constantly attends to the hole by which he entered, gnawing away the sides, so as to make them very round and smooth: for this not only allows him sufficient air, and a place through which he can expel the particles of his dung, but it is also the passage through which, when he is full fed, and ready to undergo his change, he makes his way out. About the month of September, or perhaps somewhat later, the nut becomes ripe, and falls to the ground. At this time the grub is generally prepared for the change, and works his way through the hole, which he is some time in doing, as it is much less in circumference than his body. He then buries himself in the earth, and, shortly afterwards, changes into a chrysalis; in which state he remains till the following spring, and about the beginning of May assumes his beetle form.

THE PARAPLECTIC WEEVIL*.

This insect has been in some measure rendered famous by the remarks of Linnæus, who believed that to it ought to be attributed the cause of the disease in horses, called the *staggers*. The larvæ of the Paraplectic Weevil inhabit the interior part of the stems of an umbelliferous plant, the *phellandrium aquaticum*, which grows in vast quantities in marshes and other watery places. Horses that have eaten of this plant, have been known to have this disease. Linnæus asserts, that it is not the plant which causes it, but the larvæ of these insects; since it has been remarked, that such plants as were not infested with them, had been eaten by the animals without injury.

In order to find the larvæ, the stem must be slit from top to bottom. The little creatures choose for their dwelling only that portion of the stem which is submerged. They feed, with their heads always upwards, on the substance or pith with which they are surrounded. Each stem contains only a single insect. The larvæ are each about seven lines in length, and somewhat more than a line in diameter. Their bodies are composed of twelve annules, which have transverse wrinkles on the back. The body is of a yellowish white colour, and the head brownish.

They undergo their transformations within the plants. On opening a stem towards the end of July, the larva will be found to have undergone its change into a *pupa* state, without any other case to shelter it from injury, than that which the plant itself affords. In the *pupa* all the parts of the perfect insect are very distinct. Its

* DESCRIPTION. The body of this insect is cylindrical. It is black, but covered with short cinereous hairs. The wing-cases are pointed.

SYNONYMS. *Curculio paraplecticus*. Linn.—*Le Charançon paraplectique*. Tigny.

only motion is in the abdomen; and, aided by this, it is able to pass along the cavity of the stem from one end to the other, applying for this purpose, against the parietes of the plant, the points of the abdomen, and the rows of bristles on the back.

Before the end of July these insects assume their perfect form; and, in this state, issue into day through a large oval opening, which they form with their mandibles or jaws, in that part of the stem which is above the surface of the water. These insects do not, as Linnæus has asserted, continue during the winter within the plants.

THE DOCK WEEVIL*.

On the leaves and flowers of some of the species of Dock, or *Rumex*, the larvæ of these insects are occasionally very numerous. They are usually found from the commencement of spring, until Midsummer. They are about three lines in length, and have a black and shining head. The three first rings of the body are black above, yellow on the sides, and greenish below. There is on each ring, beneath the body, a pair of fleshy teats, which supply the place of feet in walking. The under part of the body is also supplied with a viscous matter, by which they are enabled to hold themselves firmly fixed to the stems and leaves of plants.

In order to undergo their transformation into the *pupa* state, they spin a nidus, either on the stems of the plants which they inhabit, or amongst the flowers at the summit of the stem. This nidus is spherical, about

* DESCRIPTION. The whole body is black, covered with cinereous hairs. The wing-cases are dark, varied with cinereous. The antennæ are brown at the base, and black at the extremity.

SYNONYMS. *Curculio rumicis*. Linnæus.—Le Charançon de l'Oseille. Tigny.

the size of a pea, and very beautiful. It is composed of a yellowish or whitish silk, woven with meshes, and appears not unlike a sphere of the finest gauze, having the insect perfectly visible within it. In spinning this, the larva holds its body curved in a somewhat semicircular shape, by which the round shape of the nidus is obtained; its own body serving as the mould. A few days after this is completed, the insect changes to a *pupa* of a black colour. In this state it continues about twelve days, and then undergoes its final transformation.

OF THE CERAMBIX OR CAPRICORN TRIBE*.

The insects of the present tribe are among the most beautiful that are known. Their antennæ are frequently longer than the body. Many of the species diffuse a strong smell, perceptible at a great distance; and some of them, when seized, emit a sort of cry, produced by the friction of the thorax on the upper part of the abdomen and wing-cases.

Their *larvæ* are found in the inner parts of trees, through which they bore, feeding on and pulverizing the substance of the wood. They are transformed into perfect insects in the cavities they thus make, and never issue from their retreats till they have attained their perfect state.

THE TIMBER CAPRICORN†.

Both in its perfect and in its larva state this insect

* The antennæ of the Cerambyces are tapering and articulated. The thorax has several prominences; and the wing-cases are long and narrow. To the mouth there are four palpi, or feelers.

† DESCRIPTION. The body of this insect is of a dark violet colour, somewhat hairy and punctured. The thorax is rounded and downy; and the antennæ are nearly as long as

feeds principally on fir timber, which has been felled some time, without having had the bark stripped off. The circumstance of its attacking only such timber as has not been stript of its bark, ought to be attended to by all persons who have any concern in this article; for the bark is a temptation not only to this but to various other insects; and much of the injury done in timber might be prevented, if the trees were all barked as soon as they were felled.

The female is furnished at the posterior extremity of her body with a flat, retractile tube. This she inserts between the bark and the wood, to the depth of about a quarter of an inch, and there deposits a single egg.

By stripping off the bark, it is easy to trace the whole progress of the larva, from the spot where it is hatched, to that where it attains its full size. It first proceeds in a serpentine direction, filling the place which it leaves with its excrement, resembling saw-dust, and so stopping all ingress to enemies from without. When it has arrived at its utmost dimensions, it does not confine itself to one direction, but works in a kind of labyrinth, eating backwards and forwards; which gives the wood under the bark a very irregular surface: by this means its paths are rendered of considerable width. The bed of its paths exhibits, when closely examined, a curious appearance, occasioned by the erosions of its jaws, which excavate an infinity of little ramified canals. When the insect is about to assume its pupa state, it bores down obliquely into the solid wood, to the depth sometimes of three inches, and seldom, if

the body. The wing-cases are narrow, rounded at the tip, and bulging towards the base. The head and thorax are sometimes greenish. The body is from four lines and a half to seven and half in length.

SYNONYMS. *Cerambyx violaceus*. *Linnaeus*.—*Callidium violaceum*. *Fabricius*.

ever, less than two. These holes are nearly semi-cylindrical, expressing exactly the form of the grub.

At first sight, one would wonder how so small, and seemingly so weak an animal, could have strength to excavate so deep a mine; but when we examine its jaws, our wonder ceases: these are large, thick, and solid sections of a cone, divided longitudinally, which, in the act of mastication, apply to each other the whole of their interior plane surface; so that they grind the insect's food like a pair of millstones.

Some of the larvæ are hatched in October; and it is supposed that about the beginning of March they assume their *pupa* state. At the place in the bark, opposite to the hole from whence they descended into the wood, the perfect insects gnaw their way out, which generally takes place betwixt the middle of May and the middle of June.

These insects are supposed to fly only in the night, but during the day they may be generally found resting on the wood from whence they were disclosed.

The larvæ are destitute of feet, pale, folded, somewhat hairy, convex above, and divided into thirteen segments. Their head is large and convex.

OF THE LAMPYRIS OR GLOW-WORM TRIBE*.

The name of this insect is derived from the luminous appearance of the posterior part of its abdomen. The males are all winged, but most of the females are destitute of wings. In some of the species the males are not luminous. The larvæ, which feed chiefly on plants and leaves, nearly resemble the females in appearance.

There are about sixty known species, inhabitants of

* The antennæ are thread-shaped. The thorax is plain, somewhat orbicular, and conceals the head. The segments of the abdomen terminate in folded papillæ.

different parts of the world; one only of which is found in Great Britain.

THE COMMON GLOW-WORM *.

During the summer season these insects are observed after sun-set, in meadows, by road sides, and near bushes. Among the crooked lanes, in every hedge, the Glow-worm lights his gem, and

through the dark
A moving radiance twinkles.

They are chiefly to be seen during the month of June. In the day-time they conceal themselves amongst the leaves of plants.

Each sex is luminous, but in the male the light is less brilliant than in the female, and is confined to four points, two of which are situated on each side of the two last rings of the abdomen. The utility of the bright light of the females is supposed to consist in attracting the attention of the males during the dark, when, only, they are able to render themselves conspicuous. They always become much more lucid when they put themselves in motion. This would seem to indicate that their light is owing to their respiration; in which process, it is probable, phosphoric acid is produced by the combination of oxygen gas with some part of the blood, and that a light is given out through their transparent

* See Plate xviii. Fig. 4, 5.

DESCRIPTION. The male Glow-worm is smaller than the female: their heads are of the same shape, and equally concealed by the plate of the thorax. The principal difference between the sexes consists in the abdomen of the male being covered with brown wing-cases, shagreened, and marked longitudinally with two lines: these are longer than the abdomen. The female is destitute of wings.

SYNONYMS. *Lampyrus noctiluca.* Linn.—*Lampyre lumineux.* Latreille.

bodies by this slow internal combustion. By contracting themselves, the insects have a power of entirely withdrawing it: when they are at rest, very little light is to be seen. M. Templer, who made many observations on these insects, says that he never saw a Glow-worm exhibit its light at all, without some sensible motion either in its body or legs. This gentleman, when the light was most brilliant, fancied that it emitted a sensible heat.

If the insect be crushed, and the hands or face be rubbed with it, they contract a luminous appearance, similar to that produced from phosphorus. When a Glow-worm is put into a phial, and the phial is immersed in water, a very beautiful irradiation will be found to take place.

The female glow-worms lay a great number of eggs on the turf or plants on which they live. These eggs are somewhat large for the size of the insects, of a round shape, and lemon colour. When first deposited, they are covered with a yellow, viscous matter, which serves to fix them to the plant.

When full grown the larvæ are about an inch long, and so nearly resemble the females in appearance, that it is a difficult matter to distinguish the sexes. When they change to their *pupa* state, the skin generally splits on the middle of the head and back, and leaves an opening sufficient to give passage to the whole body.

As soon as the larva is completely disengaged from the skin, it curves its body into an arc, and is then in a *pupa* state. It still has much resemblance to the larva. The only indication of life now, is its curvature, from time to time, downwards, and its moving occasionally from side to side.

OF THE ELATER OR SKIPPER TRIBE*.

The Elaters fly with great facility, and when thrown

The antennæ are filaform, and for the most part serrated.

upon their backs, they are able to recover their position without using their feet: for this purpose the thorax terminates in a strong, elastic spine, which is placed in a cavity of the abdomen. The insects, when upon their back, raise up the middle part of their body, so as to leave only the head and tail in contact with the plane on which they lie. The spine of the thorax is by this motion brought considerably out of its lodgment, and made to press against the side. Being from this position again slipped into its groove, with all the force the creatures are able to exert, the thorax and abdomen come together with so sudden a jerk, as to raise the body from the plane, and enable them to spring round.

The larvæ live and undergo their changes in the trunks of decayed trees.

THE NIGHT-SHINING SKIPPER*.

In the savannahs of most of the warmer parts of America, these insects are to be seen in great numbers, and also about the woods of several of the West India islands.

They are extremely luminous in the dark, the light proceeding chiefly from four parts; namely, from two glandular spots behind the eyes, and one under each wing. But they have the property of interrupting this light at pleasure, when these glandular spots become

The under part of the thorax terminates in an elastic spine, placed in the cavity of the abdomen.

* See Plate xviii. Fig. 2.

DESCRIPTION. This insect is of an oblong form, and an inch or upwards in length. It is so strong, and exerts such elastic powers, as, when placed on its back, sometimes to spring to the height of four or five inches in recovering its natural position. Its colour is brown, except the head, which is small and blackish.

SYNONYMS. *Elater noctilucus.* Linn.—Larger Fire-fly. *Brown.*—Flies shining like Glow-worms. *Purchar.*

perfectly opaque. When the rings of the abdomen are forced a little asunder, the same luminous appearance will be seen to issue indiscriminately from every part of their interior.

A person may with great ease read the smallest print by the light of one of these insects held between the fingers, and gradually moved along the lines, with the luminous spots above the letters : but if eight or ten of them be put into a phial, the light will be sufficiently great to admit of writing by it. Oviedo says, that the Indians travel in the night with them fixed to their feet and hands; and that they spin, weave, paint, dance, &c. by their light. He also conjectures, that "a marvellous water would come from them if distilled!"

They are seldom to be seen abroad during the day, for, except in the night, they are so inanimate, as even scarcely to exhibit any signs of life. The Indians principally value them from their hunting and devouring the mosquitoes in their habitations, which would become otherwise excessively troublesome. They catch them in the night, by holding up a torch on some eminence, to the light of which the insects soon come, when they are beaten down with the branches of trees; or sometimes one of them is held up in the fingers and moved about, which will attract to the place such as are near, when they are either knocked down or seized with the hand.

The use of their light, as in the glow-worms, seems to consist in discovering the sexes to each other.

OF THE DYTISCUS OR WATER-BEETLE TRIBE*.

The bodies of these insects are admirably formed for passing through the water with as little impediment as possible, being nearly boat-shaped, and on the surface

* The antennæ are setaceous. The sturnum is cleft; and the body oval, and keel-shaped beneath. The hind legs are fringed on the inner sides, and formed for swimming.

perfectly smooth. They inhabit ponds and ditches, but occasionally fly in search of other waters. The males are distinguished from the females, by having a horny concave flap or shield on the fore-legs. The hind-legs in both sexes are peculiarly adapted for the aquatic residence of the insects, being furnished on the inner sides with a series of long and close-set filaments, so as somewhat to resemble fins. In the large species, the elytra or wing-cases of the males are smooth, and those of the females furrowed.

The larvæ are extremely voracious, feeding on other aquatic insects, on worms, and even on young fish. They continue in this state about two years and a half; and when about to change into *pupæ*, they form a convenient cell, and secrete themselves for the purpose in the banks or amongst the weeds.

THE MARGINED WATER-BEETLE*.

Although water is the principal element in which these insects reside, they are perfectly amphibious. They may occasionally be found in all fresh waters; but are most frequently seen either in such as are stagnant, or where the stream is extremely slow.

They are predatory and very voracious, devouring, in great numbers, not only other water-insects, but also those of the land. They seize their prey in their fore-legs, and with these carry it to their mouth. Although they are able to continue immersed for a great length of time, yet it is necessary for them to rise occasionally to the surface of the water, in order to breathe. They

* DESCRIPTION The body is black. The edges of the thorax, and the outer margins of the wing-cases, are yellow. The wing-cases of the females have numerous longitudinal grooves.

SYNONYMS. *Dytiscus marginalis*. Linn.—Le Dytisque bordé. Cuvier.

swim with great celerity; and, in flying, they make a humming or droning noise, like other Beetles.

The larvæ have powerful jaws, and six long legs. At the posterior part of their body, which tapers towards the extremity, there are two small, slender processes, situated somewhat obliquely, and moveable at the base. It is by means of these that the larva suspends itself at the surface of the water, for the purpose of respiring the air of the atmosphere, which it does through two small cylindrical tubes, situated at the extremity of the tail.

When the larvæ change their place in the water, or seek to escape the attack of their enemies, they give a prompt and vermicular motion to their body, and strike the water forcibly with their tail. They are excessively voracious, subsisting chiefly on the larvæ of dragon-flies, ephemeræ, gnats, and other insects. When the time of their transformation approaches, the larvæ quit the water, and enter the earth near the banks of the ponds or ditches which they frequent. Here they form a cavity in the form of an oval case, in which they undergo their change into *pupæ*, and afterwards into winged insects.

Thus these little creatures are aquatic animals in the larva state, become terrestrial under the form of *pupæ*, and amphibious when perfect insects.

OF THE CARABUS OR GROUND BEETLE TRIBE*.

These insects are very active and voracious, devouring the larvæ of the other tribes, and indeed all the smaller animals they can overcome. They conceal themselves under stones, or moss, and particularly

* The antennæ are thread-shaped. The feelers are mostly six in number, and the last joint of each is obtuse. The thorax is flat, and both this and the shells are margined.

38 THE BOMBARDIER, OR EXPLODING BEETLE.

under such as happen to be near the roots of old trees. Frequently, however, they are to be seen running about on the roads and fields. Some of the species are destitute of wings.

The larvæ are found chiefly in decayed wood, or under the ground, where they undergo their various changes.

THE BOMBARDIER, OR EXPLODING BEETLE*.

This insect conceals itself among stones, and seems to make little use of its wings. When it moves it is by a sort of jump; and, when it is touched, we are surprised with a noise resembling the discharge of a musket in miniature, during which a blue smoke may be seen to proceed from its extremity. The insect may at any time be made to play off its artillery, by scratching its back with a needle. If we may believe Rolander, who first made these observations, it can give twenty discharges successively. A bladder, placed near its posterior extremity, is the arsenal that contains its store. This is its chief defence against its enemies; and the vapour or liquid that proceeds from it is of so pungent a nature, that, if it happen to be discharged into the eyes, it makes them smart as though brandy had been thrown into them. The principal enemy of the Bombardier is another insect of the same tribe, but three or four times its size. When pursued and fatigued, the Bombardier has recourse to this stratagem: he lies down in the path of his enemy, who advances with open mouth to seize him; but, on the discharge of the artillery, the enemy suddenly draws back, and re-

* **DESCRIPTION.** The head, antennæ, thorax, and feet, of this insect, are of a brownish red colour. The eyes are black, and the abdomen and wing-cases blue, nearly black; the latter are marked with broad but shallow striæ. This insect is sometimes found in England.

SYNONYMS. *Carabus crepitans.* Linn.—Le Bombardier, ou Carabe Petard. Latreille.

mains for a while confused, during which the Bombardier conceals himself in some neighbouring crevice; but, if not lucky enough to find one, the other returns to the attack, takes the insect by the head, and tears it off.

OF THE LYTTA TRIBE.

The antennæ of the Lyttæ are of equal thickness throughout; the feelers are four in number, unequal in size, and the hind ones are clavate. The thorax is roundish: the head inflected and gibbous. The shells are soft, flexible, and as long as the abdomen.

THE BLISTERING LYTTA, OR SPANISH-FLY*.

In the south of France, in Spain, and in Italy, these insects are found in great abundance about the time of the summer solstice. They feed on the leaves of trees and shrubs, particularly on those of the privet, lilac, woodbine, elder, poplar, and ash. On the last-named trees they are sometimes seen in such swarms, as, in a little while, to deprive them entirely of their verdure. They always prefer the young trees to old ones. When collected in great numbers their odour becomes very disagreeable, and is perceptible even to a considerable distance.

In order to collect these insects, a cloth is extended round the foot of the tree, and they are shaken upon it. They are then taken up, tied in a bag, and killed

* See Plate xviii. Fig. 3.

DESCRIPTION. These beautiful insects are about an inch long, and of a shining blue-green colour. They sometimes fly in swarms, and have a nauseous smell, not much unlike that of mice. When dried, they are so light, that fifty of them will scarcely weigh a single drachm.

SYNONYMS. *Lytta vesicatoria*. Linn. Gmel.—*Cantharide vésicatoire*. Latreille.—Spanish fly, or *Cantharides*, in England.

with the vapours of hot vinegar. After this they are dried in the sun, and placed in boxes for use. The fresher the insects are, the more stimulating is the action of their blistering properties. It is consequently necessary to collect them as shortly as possible after they have attained their perfect state.

The ancient Greeks and Romans were acquainted with the qualities of these insects. They are mentioned by Cicero, Pliny, Dioscorides, and Galen.

The odorous particles exhaled by them, are extremely corrosive, and it is necessary to use great caution in taking them up. People have experienced their dangerous effects, by gathering a quantity of these insects during the heat of the sun, with their hands bare, or by having fallen asleep under the trees where swarms of them had settled.

The females lay in a mass, or sometimes separately, their very small eggs, of a cylindrical form, and yellowish colour. These are hatched in about fifteen days.

The larvæ are soft, flat, whitish, and sparingly covered with small bristles. Their bodies are composed of twelve or thirteen segments, of which the three first have each two legs. In this state they appear to live in the earth, where they subsist on the roots of plants.

OF THE FORFICULA OR EARWIG TRIBE.

In this tribe the antennæ are bristle-shaped; and the feelers unequal and thread-shaped. The wing-cases are half the length of the abdomen, and have the wings folded up under them, somewhat in the manner of a fan. The tail is armed with a forceps.

The Earwigs undergo only a semi-metamorphosis, differing in external appearance very little in the three states.

THE COMMON EARWIG*.

It may not perhaps be generally known that the Earwig possesses wings which are both large and elegant, and that one of these, when extended, will cover nearly the whole insect. The elytra or wing-cases, are short, and extend not along the whole body, but only over the breast. The wings are concealed beneath these, and are somewhat of an oval shape. There is great elegance in the manner in which the insect folds them beneath its elytra. They are first closed up lengthways from a centre close to the body, like a fan; and afterwards refolded across in two different places, one about the middle of the membrane, and the other at the centre, from which the first folds proceeded. By this means the wing is reduced into a small compass, and proportioned to the size of the case under which it is to lie.

It is a circumstance extremely singular, that, unlike those of most others of the insect tribe, the eggs are hatched and the young Earwings are fostered by the parent. At the beginning of the month of June, M. de Geer found under a stone a female Earwig, accompanied by many little insects, which evidently appeared to be her own young. They continued close to her, and often placed themselves under her belly, as chickens do under a hen. He put the whole into a box of fresh earth: they did not enter the earth, but it was pleasing to observe how they thrust themselves under the belly, and between the legs of the mother, who remained very quiet, and suffered them to continue there sometimes for an hour or two together. To feed them this gentleman gave them a piece of a very ripe apple: in an instant the old one ran upon it, and ate with a good appetite; the young-ones also seemed to eat a little, but apparently

* SYNONYMS. *Forficula auricularia*. Linn.—Twitch, or Twitchball, in some parts of the north of England.

with much less relish. On the eighth of June he remarked, that the young Earwigs had changed their skins, and he found also the sloughs that they had quitted. This moulting produced only a slight change in their figure, yet it evidently brought them nearer to the perfect insect.

At another time, about the beginning of April, he found a female Earwig under some stones, placed over a heap of eggs, of which she took all the care imaginable, without ever forsaking them. He took both the female and her eggs, placed her in a box half filled with fresh earth, and dispersed the eggs up and down in it. She, however, soon removed them, one after another, carrying them between her jaws; and, at the end of a few days, he saw that she had collected them all into one place upon the surface of the earth, and remained constantly on the heap, without quitting it for a moment; so that she seemed truly to sit for the purpose of hatching her eggs. The young-ones were produced about the thirteenth of May. In figure they were similar to those before mentioned; but at their birth they were all white, except towards the tail, where a yellow matter was observable through the skin, and the eyes and teeth, which were reddish. He kept them in a box with their mother, feeding them from time to time with bits of apple, and saw them grow every day, and change their skins more than once. The mother died, and her progeny devoured nearly the whole of her body. The little ones that died also underwent the same fate. M. de Geer, however, conjectures that this took place only from want of other food, as he had neglected to supply them regularly with nutriment. On the twenty-third of July one only remained alive: it was full grown, and then in the *pupa* state.

The larvæ of Earwigs differ little in their external appearance from the complete insects, except that they have neither wings nor elytra, and that the breast and thorax are not distinguishable. In this state they are very lively little animals, running about with great

agility, even from the instant they leave the egg. On their metamorphosis to a perfect insect, part of their body bursts behind, and gives full play to the wings.

The Earwig, though in its nature extremely harmless, except to fruits and vegetables in our gardens, has become a victim to human cruelty and caprice, originating in a notion that it introduces itself into the ears, and thence penetrates to the brain, and occasions death. It is to be wished that females, who but too commonly lay aside all ideas of tenderness at the very sight of it, would be convinced that the wax and membranes of the ears, are a sufficient defence against all the pretended attacks of the Earwig upon this organ.

Our gardeners have, it is true, some room for complaint. It lives among flowers, and frequently destroys them; and, when fruit has been wounded by flies, the Earwigs also generally come in for a share. In the night they may occasionally be seen in amazing numbers upon lettuces and other esculent vegetables, committing those depredations that are often ascribed to snails or slugs. The best mode, therefore, of destroying them, seems to be, to attend the garden now and then in the night, and to seize them while they are feeding.

The bowl of a tobacco-pipe, and the claws of lobsters stuck upon sticks that support flowers, are the usual methods by which they are caught, as, in the daytime, they creep into holes and dark places. Placing hollow reeds behind the twigs of wall-trees, is also a good mode, if they be examined and cleared every morning. But at a midnight visit more may be done in an hour, than by any of the other means in a week.

Hemipterous Insects*.

OF THE *BLATTA* OR COCK-ROACH TRIBE†.

Some of the species of *Blatta*, are destitute both of wings and wing-cases. Their larvæ differ but little in their general appearance from the perfect insects. In a *pupa* state they have, between the thorax and the abdomen, two broad and flat rings, which cover much of the breast, and from which place the wings afterwards appear.

A few of these insects live in houses, and others conceal themselves in holes in the ground.

THE COMMON‡ AND THE AMERICAN COCK-ROACH§.

Both these insects live in houses, where they are sometimes very troublesome, from their gnawing and devouring eatables, leather, clothes, woollen, and other things to which they have access. The common spe-

* The insects of the Linnean order *Hemiptera*, have their upper wings half crustaceous, and half membranaceous; not divided by a longitudinal suture, but incumbent on, or crossed over each other.

† The body is flat, and the thorax broad and margined, having the head concealed beneath. The elytra are very large. The legs are long. The abdomen terminates in four spines or bristles.

‡ DESCRIPTION. This insect is about an inch in length, and of an uniform reddish brown colour. The females are destitute of wings.

SYNONYMS. *Blatta orientalis*. Linn.—La Blatte des Cuisines. Tigny.

§ DESCRIPTION. The body and wing-cases are ferruginous; and the thorax is whitish behind.

SYNONYMS. *Blatta Americana*. Linn.—La Blatte Kakkerlac. Tigny.

cies is well known in this country, but more particularly in bakehouses and kitchens in London and its neighbourhood. They are extremely agile, and run very swiftly. During the day-time they conceal themselves in holes of walls and clefts of the floors, and issue forth only in the dark, for the purposes of plunder and devastation. The moment they perceive a light, they endeavour to escape into the places of their retreat. The smell of these insects is so powerful and unpleasant, that if they only run over provisions, they frequently render them very nauseous. They are furnished with wings, but their agility in other respects is so great, that they seldom use them.

The eggs of the Common Cock-roach are large, and rounded at the extremities; and the sides are raised into somewhat of a keel-shape. The larvæ are able to run nimbly from the moment they have life.

The Kakerlac, or *American Cock-roach*, is very common on the New Continent, and has sometimes also been found in Europe. In some parts of South America, particularly in Surinam, it causes great devastation in the houses, by gnawing the stuffs, cloths, and wool, and devouring and injuring the provisions.

It is asserted by Reaumur, that the American Cock-roaches have for an enemy a large species of sphex. He says, that when one of these sphages encounters a Cock-roach, it seizes it by the head, pierces it with its sting, and then carries it to its hole, the nidus, where, no doubt, it has deposited its egg, and where the Cock-roach serves as nourishment for the future young one.

OF THE MANTIS TRIBE*.

Many of the insects of the present tribe have, at a

* In the insects of this tribe, the head appears but slightly attached to the thorax. The mouth is armed with jaws, and

little distance, so much the appearance of leaves of trees, that, in countries where they are common, travellers have been struck with the singular phenomenon of what seemed to them animated vegetable substances. Their most prevailing colour is a fine green, but many of them become brown after they are dead: some, however, are decorated with a variety of lively hues. The thorax in most of them is very long and narrow, and has the appearance of a footstalk to the large and rounded abdomen. Their manners also, in addition to their structure, are very likely to impose on the senses of the uninformed: they often remain on the trees for hours without motion; then, suddenly rising, they spring into the air, and when they settle, they again appear lifeless. These seem to be stratagems, in order to deceive the cautious insects on which they feed. Some travellers, however, have declared that they saw the leaves of trees become living creatures. Many of the Indians of South America, believe that these insects grow on the trees like the leaves, and that, when they have arrived at maturity, they loosen themselves, and crawl or fly away.

The Africans consider the whole tribe, according to some writers, as sacred; but, according to others, only as animals of good omen. One of the species (*Mantis fausta*) has obtained the name of the *Hottentot's God*, and is supposed to be an object of worship among that people. Professor Thunberg could not, however, observe any reason for this supposition: he says, it is held by them in such esteem, that they would not willingly injure it; and that they account any person or creature fortunate on whom it alights; but all

has its feelers filiform. The wings are four, membranaceous and convolute, the under ones plaited. The fore-legs are compressed, serrated, or toothed beneath; and armed with a single claw, and a lateral jointed process. The hind legs are smooth, and formed for walking, and not for leaping, as in the next tribe.

this appeared to him to be done without paying to it any thing like divine honour.

None of the species have ever been found in this country.

THE ORATOR MANTIS*.

This is a very widely-dispersed species, being found both in Europe, Asia, and Africa. From its perpetually resting on its hind legs, and erecting the fore paws close together, with a quick motion, as if in the action of praying, the country people, in various parts of the continent, consider it almost as sacred, and would not on any account injure it. "It is so divine a creature, (says the translator of Mouffet,) that if a child has lost its way, and inquires of the Mantis, it will point out the right path with its paw." Dr. Smith, however, informs us, in his tour on the continent, that he received an account of this Mantis that seemed to savour little of divinity. A gentleman caught a male and female, and put them together in a glass vessel. The female, which in this, as in most other insects, is the largest, after a while devoured first the head and upper parts of her companion, and afterwards all the remainder of the body.

The offspring of this Mantis are preserved in the egg-state in a kind of oblong bag, of a thick, spongy substance: this bag is imbricated on the outside, and fastened lengthwise to the branch of some plant. As the eggs ripen, they are protruded through the thick substance of the bag, and the larvæ, which are about half an inch in length, burst from them.

Roesel, wishing to observe the gradual progress of these creatures to the winged state, placed the bag con-

* See Plate xix. Fig. 4.

DESCRIPTION. The thorax is smooth. The wing-cases are of a bright green colour; and on each of the wings there is a black spot.

SYNONYMS. *Mantis oratoria*. Linn.—LePrie-Dieu, in some parts of France.

taining the eggs in a large glass, which he closed, in order to prevent their escape. From the time they were first hatched, they exhibited marks of a savage disposition. He put different sorts of plants into the glass, but they refused them for the purpose of preying on one another. This determined him to supply them with insect food. He put several ants into the glass to them; but they then betrayed as much cowardice as they had before done of barbarity; for the instant the *Mantes* saw the ants, they attempted to escape in every direction. This was evidently an instinctive fear of a natural enemy. He next gave them some of the common house-flies, which they seized with eagerness in their fore-claws, and tore in pieces. But, notwithstanding their apparent fondness of flies, they continued to destroy each other through savage wantonness. Despairing at last, from their daily decrease, of rearing any to the winged state, he separated them into small parcels in different glasses; but here, as before, the strongest of each community destroyed the rest.

He afterwards received several pairs of *Mantes* in the winged state. Profiting by his former observations, he now separated them, placing a male and a female together in different glasses; but they still exhibited signs of a rooted enmity to each other, which neither age nor sex could soften. The instant they were in sight of each other, they threw up their heads, brandished their fore-legs, and each waited an attack. They did not long remain in this posture; for the boldest, throwing open his wings with the velocity of lightning, rushed at the other, and often tore it in pieces. Roesel compares the attack of these creatures to that of two hussars; for they dexterously guard and cut with the edge of the fore-claws, as those soldiers do with sabres, and sometimes at a stroke one of them cleaves the other through, or severs its head from the thorax. After this, the conqueror always devours his vanquished antagonist.

The patience of the *Mantis* in waiting for his prey,

is remarkable, and the posture to which superstition has attributed devotion, is no other than the means it uses to catch it. When it has fixed its eyes on an insect, it rarely loses sight of it, though it may cost some hours to take it. If it see an insect a little beyond its reach, over its head, it slowly erects its long thorax, by means of the moveable membranes that connect it to the body; then, resting on the posterior legs, it gradually raises the anterior part also. If this bring it near enough to the insect, it throws open the last joint of its fore paws, and snaps the insect between the spines that are set in rows on the second joint. If it be unsuccessful, it does not retract its paws, but holds them stretched out, and waits again till the insect is within its reach, when it springs up and seizes it. Should the insect go far from the spot, it flies or crawls after it slowly on the ground, like a cat; and, when the insect stops, it erects itself as before.

These *Mantes* have a small black pupil or sight, which moves in all directions within the parts that we usually term the eyes, so that they can see their prey in any direction, without having occasion to disturb it by turning their head.

The males die in October, and the females do not long survive them.

THE DRY-LEAF MANTIS*.

This insect, in its shape and colour, is so exceedingly remarkable as to have uniformly suggested the idea of a dry or withered leaf; and, when its wings are closed, it bears so great a resemblance to a leaf, that, on a cursory view, it might easily be mistaken for one.

The specimens that are brought to Europe, are generally of a yellowish-brown colour. The wings, when

* See Plate xix. Fig. 5.

SYNONYMS. *Mantis siccifolia*. Linn.—La Feuille sèche. Cuvier.

closed, form the oval body of the leaf, and the narrow thorax and head resemble the stalk. It is a native of India.

OF THE GRYLLUS OR LOCUST TRIBE.

All these insects feed chiefly on vegetable substances. The *larvæ* and *crysalids* nearly resemble the perfect insects: they have six legs, are voracious and active, and reside principally in the ground.

Their heads are inflected, and armed with jaws that are furnished with filiform palpi, or feelers. The antennæ in some species are taper, in others thread-shaped. The wings are four, deflected and convolute; the lower ones plaited. The hind legs are formed for leaping; and on each side of the feet are two claws.

THE MOLE CRICKET*.

The female of this species forms a cell of clammy earth, about the size of a hen's egg, closed up on every side, and as large in the interior as two hazel nuts. The eggs, amounting to nearly a hundred and fifty, are white, and about the size of caraway comfits; they are carefully covered, as well to defend them from the injuries of weather as from the attacks of a species of black beetles, which often destroy them. The female

* DESCRIPTION. This little creature, among the insect tribes, is a complete representative of the mole. Its fore feet are broad and strong, and in their formation and position bear a great resemblance to the fore feet of that animal. They are used for precisely the same purpose of burrowing under the surface of the ground, where the insect commonly resides; and so expertly does it use them, that it can penetrate the earth with even greater expedition than the mole.

SYNONYMS. *Gryllus Gryllo-talpa*. Linn.—*Acheta gryllo-talpa*. Fabricius.—Fenn-Cricket, Chur-worm, Eve-churr, in different parts of the kingdom.—Courtillere, ou Gryllon-taube, in France.

places herself near the entrance of the nest, and whenever the beetle attempts to seize its prey, the guardian insect catches it behind, and bites it asunder. Nothing can exceed the care of these animals in the preservation of their offspring. Wherever a nest is situated, fortifications, avenues, and entrenchments surround it: there are also numerous meanders which lead to it, and a ditch encompasses the whole, which few other insects are capable of passing.

About the middle of April, if the weather be fine, and just at the close of day, the Mole Crickets utter a low, dull, jarring note, not much unlike the chattering of the goat-sucker. In the beginning of May they lay their eggs. Mr. White says that a gardener, at a house where he was on a visit, happening to be mowing by the side of a canal, on the sixth of May, his scythe struck too deep, pared off a large piece of turf, and laid open to view a curious scene of domestic oeconomy. There were many caverns and winding passages leading to a kind of chamber, neatly smoothed and rounded, and about the size of a moderate snuff-box. Within this secret nursery were deposited nearly a hundred eggs, of a dirty yellow colour, and enveloped in a tough skin, but too lately excluded to contain any rudiments of young-ones, being full of a viscous substance. The eggs lay but shallow, and within the influence of the sun, just under a little heap of fresh mould, like that which is raised by ants.

At the approach of winter, the Mole Crickets remove their nest to so great a depth in the earth, as to have it always lower than the frost can penetrate. When the mild season comes on, they raise it in proportion to the advances of that favourable time, and at last elevate it so nearly to the surface, as to render it susceptible both of air and sun-shine; and if the frost returns, they again sink it to its proper depth. A similar method is practised by the ants with their nests.

Mole Crickets are troublesome insects in hot-beds,

where they make great havock, by hacking and gnawing the roots of plants with their fore-feet, the ends of which are armed with teeth like a saw.

The Rev. Mr. Gold kept a Mole Cricket alive during several of the summer months. He fed it on the larvæ and chrysalids of ants, which it seized with great voracity.

THE HOUSE CRICKET*.

These busy little insects reside altogether in our dwellings, and intrude themselves on our notice, whether we wish it or not. They are partial to houses newly built; for the softness of the mortar enables them without difficulty to form their retreats between the joints of the masonry, and immediately to open communications with the different rooms. They are particularly attached to kitchens and bakehouses, as affording them a constant warmth.

"Tender insects, that live abroad, (says Mr. White,) either enjoy only the short period of one summer, or else doze away the cold, uncomfortable months in profound slumbers; but these, residing as it were in a torrid zone, are always alert and merry: a good Christmas fire is to them, what the heats of the dog-days are to others.

"Though they are frequently heard by day, yet their natural time of motion is only in the night. As soon as it becomes dusk the chirping increases, and they come running forth, and are often to be seen in great numbers, from the size of a flea to that of their full stature.

Around, in sympathetic mirth,
Its tricks the kitten tries;
The Cricket cherups in the hearth,
The crackling faggot flies.

* SYNONYMS. *Gryllus domesticus*. Linn.—*Acheta domestica*. Fabricius.

"As one would suppose from the burning atmosphere which they inhabit, they are a thirsty race, and show a great propensity for liquids, being frequently found dead in pans of water, milk, broth, or the like. Whatever is moist they are fond of, and therefore they often gnaw holes in wet woollen stockings and aprons, that are hung to the fire. These Crickets are not only very thirsty but very voracious; for they will eat the scummings of pots, yeast, salt, and crumbs of bread; and kitchen offal or sweepings of almost every description.

"In the summer they have been observed to fly, when it became dusk, out of the windows, and over the neighbouring roofs. This feat of activity accounts for the sudden manner in which they often leave their haunts, as it does also for the method by which they come to houses, where they were not known before. It is remarkable, that many sorts of insects seem never to use their wings, but when they wish to shift their quarters and settle new colonies. When in the air, they move in waves or curves, like woodpeckers, opening and shutting their wings at every stroke, and thus are always rising or sinking. When their numbers increase to a great degree, they become pests, flying into the candles, and dashing into people's faces. In families, at such times, they are, like Pharaoh's plague of frogs, 'in their bed-chambers, and upon their beds, and in their ovens, and in their kneading troughs.'

"Cats catch hearth-crickets, and, playing with them as they do with mice, devour them. Crickets may be destroyed like wasps, by phials half filled with beer, or any liquid, and set in their haunts; for, being always eager to drink, they will crowd in till the bottles are full." A popular prejudice, however, frequently prevents any attempts at their destruction; many people imagining that their presence is attended with good luck, and that to kill or drive them away will bring some misfortune on the family.

When these insects are running about a room in the

dark, if they be surprised by a candle, they give two or three shrill notes. These seem a signal to their fellows that they may escape to their crannies and lurking holes, for the purpose of avoiding danger.

It is said that, in some parts of Africa persons make a trade of these Crickets. They feed them in a kind of iron oven, and sell them to the natives, among whom, the noise they make is thought pleasing. These people imagine that it assists in lulling them to sleep.

The organ that produces this noise, is a membrane, which, in contracting, by means of a muscle and tendon placed under the wings of the insect, folds down somewhat like a fan. This, as it is always dry, yields, by its motion, a sharp and piercing sound. The noise may even be heard after the insect is dead, if the tendon be made to move. We are told that Crickets will live, and even continue their accustomed noise, for some time after their heads are cut off.

THE FIELD CRICKET*.

Towards sun-set is the time when the Field Crickets begin to appear out of their subterraneous habitations. They are, however, so shy and cautious, that it is no easy matter to get a sight of them ; for, feeling a person's footsteps as he advances, they stop short in the midst of their song, and retire backward nimbly into their burrows, where they lurk till all suspicion of danger is over. The Rev. Mr. White, of Selborne, who attentively studied their habits and manners, at first made an attempt to dig them out with a spade, but without much success ; for either the bottom of the hole was inaccessible, from its terminating under a large stone, or else in breaking up the ground the insect was inadvertently squeezed to death. Out of one thus bruised,

* SYNONYMS. *Gryllus campestris*. *Linnaeus*.—*Acheta campestris*. *Fabricius*.

a great number of eggs were taken, which were long and narrow, of a yellow colour, and covered with a tough skin. More gentle means were then used, and these proved successful. A pliant stalk of grass, gently insinuated into the caverns, will probe their windings to the bottom, and bring out the inhabitant; and thus the humane inquirer may gratify his curiosity without injuring the object of it.

It is remarkable, that, though these insects are furnished with long legs behind, and brawny thighs adapted for leaping, yet, when driven from their holes, they show no activity, but crawl along in so lifeless a manner as as easily to be caught. And though they are provided with a curious apparatus of wings, yet they never exert them, even when there seems to be the greatest occasion. The males only make their shrill noise, perhaps out of rivalry and emulation; as is the case with many animals, which exert some sprightly note during their breeding-time.

When the males meet, they sometimes fight very fiercely, as Mr. White found, by some that he put into the crevices of a dry stone wall, where he wished to have them settle. For though they seemed distressed by being taken out of their knowledge, yet the first that got possession of the chinks seized on all that were obtruded upon them.

With their strong jaws, toothed like the shears of a lobster's claws, these insects perforate and round their curious regular cells. When taken into the hand, they do not attempt to defend themselves, though armed with such formidable weapons. Of such herbs as grow about the mouths of their burrows, they eat indiscriminately; and they never in the day-time seem to stir more than two or three inches from their home. Sitting in the entrance of their caverns, they chirp all night as well as day, from the middle of May to the middle of July. In hot weather, when they are most vigorous, they make the hills echo; and, in the more still hours of darkness, they may be heard to a very considerable distance.

"Not many summers ago (says Mr. White) I endeavoured, by boring deep holes in the sloping turf, to transplant a colony of these insects to the terrace in my garden. The new inhabitants staid some time, and fed and sang; but they wandered away by degrees, and were heard at a greater distance every morning: so it appears that on this emergency they made use of their wings, in attempting to return to the spot from which they were taken.

"One of these Crickets, when confined in a paper cage, set in the sun, and supplied with plants moistened with water, will feed and thrive; and will become so merry and loud as to render it irksome for a person to be in the same room with it. If the plants be not wetted, it will die."

THE MIGRATORY LOCUST*.

Syria, Egypt, Persia, and almost all the south of Asia, are subject to a calamity as dreadful as volcanoes and earthquakes are to other countries, in being ravaged by those clouds of Locusts, so often mentioned by travellers. The quantity of these insects is incredible to all, who have not themselves witnessed their astonishing numbers: the whole earth is covered with them, for the space of several leagues. The noise they make in browsing on the trees and herbage, may be heard at a great distance, and somewhat resembles that of an army foraging in secret. The Tartars themselves are a less destructive enemy than these animals. One would imagine, wherever they have been seen, that fire had followed their progress. Wherever their myriads spread, the verdure of the country disappears, as if a curtain had been removed: trees and plants are stripped of their leaves, and are reduced to their naked boughs and stems; so that the dreary image of winter

* SYNONYMS. *Gryllus migratorius*. *Lin.*—Locust. *Var.*

succeeds, almost in an instant, to the rich scenery of the spring. When these clouds of Locusts take their flight, the heavens may sometimes literally be said to be obscured by them. Happily, this calamity is not frequently repeated; for it is the inevitable forerunner of famine. The inhabitants of Syria have remarked, that Locusts are always increased by too mild winters, and that they constantly come from the desert of Arabia. From this observation it is easy to conceive, that, the cold not having been rigorous enough to destroy their eggs, they multiply suddenly; and, the herbage failing them in the immense plains of the desert, innumerable legions issue forth. When they make their first appearance on the frontiers of the cultivated country, the inhabitants attempt to drive them off, by raising large clouds of smoke; but frequently their herbs and wet straw fail them. They then dig trenches, where numbers of the insects are buried: but the most efficacious destroyers are the south and south-easterly winds, and the locust-eating thrushes*. These birds follow them in numerous flocks like starlings, and not only greedily devour them, but kill as many as they can: accordingly they are much respected by the peasants, and nobody is allowed to shoot them. As to the southerly and south-easterly winds, they drive with violence these clouds of Locusts over the Mediterranean, where such quantities of them are sometimes drowned, that, when their bodies are thrown on the shore, they infect the air for several days, even to a great distance.

The annals of most hot countries are filled with accounts of the devastations occasioned by Locusts. These insects, however, seldom now visit Europe in such swarms as formerly; yet in the warmer parts of this continent they are still formidable. Those that have at uncertain intervals visited Europe, within the memory of man, are supposed to have come from

* *Turdus gryllovorus*, of Linnæus.

Africa. Some have at different times been seen in Britain, and great mischiefs have been apprehended from them; but, happily for us, the coldness of our climate, and the humidity of our soil, are each unfavourable to their production: they therefore all perish, without leaving a young generation to succeed them.

Locusts, when they take flight, seem at a distance like a dark cloud, which, as it approaches, almost excludes the light of day. It often happens that the husbandman sees them pass over without doing him any injury; but in this case they only proceed to settle on some less fortunate country. Wherever they alight, they make dreadful havock among the vegetation. In the tropical climates, their presence is not attended with such destructive consequences as in the southern parts of Europe; for in those the vegetative power is so strong and active, that an interval of only a few days will sometimes repair all the damage; but in Europe their ravages cannot be obliterated until the succeeding year. In their long flights to this part of the world, from the extent of their journey, they are also nearly famished, and therefore are more voracious, wherever they happen to alight.

We are told, that nearly as much damage is occasioned by what they touch, as by what they devour. Their bite is thought to contaminate the plants, and either to destroy or greatly to weaken their vegetation. To use the expression of the husbandmen, "they burn wherever they touch," and in some countries they leave the marks of their devastation for three or four years afterwards. When dead, they infect the air in such a manner that the stench is frequently insupportable. Orosius tells us, that in the year of the world 3800, Africa was infested with a multitude of Locusts. After having eaten up every thing that was green, they flew off, and were drowned in the sea; where they caused such a stench, as could not have been equalled by the putrefying carcasses of a hundred thousand men.

In the year 1650, a cloud of Locusts was seen to enter Russia in three different places; and thence they spread themselves over Poland and Lithuania, in such astonishing multitudes, that the air was darkened, and the earth covered with their numbers. In some places they were seen lying dead, heaped upon each other to the height of four feet; in others they covered the surface of the ground like a black cloth: the trees bent with their weight; and the damage that the country sustained from them, exceeded computation.

In Barbary, their numbers are often formidable; and Dr. Shaw, in 1724, was a witness of their devastations there. Their first appearance was about the end of March, when the wind had been southerly for some time. In the beginning of April their numbers were so increased, that in the heat of the day large swarms appeared like clouds, and darkened the sun. In the middle of May they began to disappear, retiring into the plains to deposit their eggs. In June the young brood came forth, forming many compact bodies several hundred yards square; which, afterwards marching forward, climbed the trees, walls, and houses, devouring every vegetable that was in their way. The inhabitants, in order to stop their progress, formed trenches all over their fields and gardens, which they filled with water. Some placed large quantities of heath, stubble, and other combustible matter, in rows, and set them on fire at the approach of the Locusts. This, however, was to no purpose; for the trenches were quickly filled up, and the fires put out, by the immense swarms that succeeded each other.

A day or two after one of these swarms was in motion, others that were just hatched, came to glean after them, gnawing off the young branches, and the very bark of the trees. Having lived near a month in this manner, they attained their full growth, and threw off their larva-state by casting their skins. To prepare themselves for this change, they fixed their hinder parts to some bush or twig, or corner of a stone; when,

immediately, by an undulating motion, their heads would first appear, and soon afterwards the rest of their bodies. The whole transformation was performed in seven or eight minutes; after which they remained for a little while in a weak state; but as soon as the sun and air had hardened their wings, and dried up the moisture that remained after casting their sloughs, they returned to their former greediness, with an addition both of strength and agility. But they did not long continue in this state before they were entirely dispersed. After laying their eggs, they directed their course northward, and, probably, perished in the sea.

Of the innumerable multitudes, that infested the interior parts of Southern Africa, in the year 1797, scarcely any adequate conception can be formed. Mr. Barrow says, that in the part of the country where he then was, the whole surface of an area of nearly 2000 square miles, might literally be said to be covered with them. The water of a wide river was scarcely visible, on account of the dead carcasses that floated on the surface, drowned in the attempt to come at the reeds that grew in it. They had devoured every blade of grass, and every green herb, except the reeds.

When the Locusts attack a field of corn just come into ear, this gentleman says that they first mount to the summit, and pick out every grain, before they touch the leaves and stem. They seem to be constantly in motion, and always to have some object in view. When the larvæ (for these are much more voracious than the perfect insects) are on a march during the day, it is utterly impossible to turn the direction of the troop, which is generally with the wind. Towards the setting of the sun the march is discontinued, when the troop divides into companies that surround the small shrubs or tufts of grass, or ant-hills, and in such thick patches, that they appear like so many swarms of bees; and in this manner they rest till daylight. At these times it is, that the farmers have any chance of destroying them: they sometimes drive

among them a flock of two or three thousand sheep: and by the restlessness of these, immense numbers are trampled to death.

The year 1797 was the third of their continuance in Sneuwberg; and their increase, according to Mr. Barrow's account, had far exceeded that of a geometrical progression, whose ratio is a million.

For ten years preceding their present visit, this district was entirely free from them. Their former exit was somewhat singular. All the full-grown insects were driven into the sea by a tempestuous north-west wind, and were afterwards cast upon the beach, where, it is said, they formed a bank three or four feet high, that extended nearly fifty English miles.

The female Locust, when she lays her eggs, which are generally about forty in number, retires to some solitary place underground. Here, by her sagacity, she secures them from the intemperance of the air, as well as from the more immediate danger of the plough or spade, one fatal blow of which would destroy all the hopes of a rising generation.

One would imagine, that an insect like the Locust would never have been thought of as food for man; yet it is an undoubted fact, that in several parts of Africa, the people eat them. They are dressed in different ways: some pound and boil them with milk: others only broil them on the coals, and think them excellent food. "There is no disputing about tastes, (says Mr. Adanson,) for my part, I would willingly resign whole clouds of Locusts to the negroes of Gambia, for the meanest of their fishes."

OF THE LANTERN-FLIES IN GENERAL.

In this tribe the head is extended forward, and is hollow and inflated. The antennæ, consisting of two joints, the outer one of which is globular, are seated below the eyes. The rostrum or beak* is four-jointed,

* This is a jointed sheath, situated in the mouth, and con-

and inflected, or bent inwards under the body. The legs are not formed for leaping.

THE GREAT LANTERN-FLY*.

This is the most vivid of all the luminous insects. It affords a light so great, that travellers, walking by night, are said to be enabled to pursue their journey with sufficient certainty, if they tie one or two of them to a stick, and carry this before them in the manner of a torch. This insect is common in many parts of South America, and is described by Madam Merian, in her superb work on the insects of Surinam. She gives an entertaining account of the alarm, into which she was thrown, by the flashing which proceeded from them in the dark, before she had been apprised of their shining nature.

"The Indians once brought me, (says she,) before I knew that they shone by night, a number of these Lantern-flies, which I shut up in a large wooden box. In the night they made such a noise, that I awoke in a fright, and ordered a light to be brought, not being able to guess whence the noise proceeded. As soon as I found that it came from the box, I opened it, but was still more alarmed, and let it fall to the ground in my fright, at seeing a flame of fire issue from it; and as many animals as came out, so many different flames appeared. When I found this to be the case, I recovered from my alarm, and again collected the insects, much admiring their splendid appearance." The light,

taining setæ or bristles, used in extracting the juices from plants, and for some other purposes.

* **DESCRIPTION.** The head in this species is large, and somewhat oval. The wings are variegated; and the lower pair is marked each with a large ocellated or eye-like spot. Sometimes the insect is seen of three or four inches in length.

SYNONYMS. *Fulgora lanternaria*. *Linnaeus*.—*La Fulgore porte-lanterne*, by the French.

she adds, of one of these insects, is so bright, that a person may see to read a newspaper by it.

The light emitted by this fly, proceeds entirely from the hollow part, or lantern, of the head; no other part being luminous. Dr. Darwin conjectures, that the use of this light is merely to prevent the insects from flying against objects in the night, and to enable them to procure their sustenance in the dark. He seems, however, not to have considered, that very few of the numerous train of nocturnal insects possess this luminous property, and yet all the functions of these are performed with perfect regularity. Its most essential use is, no doubt, as in the other luminous tribes, to point out the sexes to each other, serving in them the same purpose, in this respect, as the voice in larger animals.

OF THE CICADÆ IN GENERAL*.

These insects are found in various parts both of the New and Old Continent, where they subsist almost wholly on the leaves of trees and on other vegetable substances. They are furnished with a hard and horny proboscis or tube, in which is contained a very slender sucking-pipe. The former is not much unlike a gimlet in form, and is used by them in boring through the bark of trees, for the purpose of extracting their juices. With this proboscis they also bore holes in the small and tender twigs of the exterior branches, in which they deposit their eggs, sometimes to the amount of six or seven hundred. Each cell does not contain more than from twelve to twenty, so that by this means they often do much damage to the trees which they frequent.

* The Cicadæ have an inflected rostrum, and bristle-shaped antennæ. The wing-cases are membranaceous, and decline along the sides of the body. Their legs are in general formed for leaping.

The *chrysalids* of these insects are not torpid, like those of many others; but have six legs, and differ from the parent, in having only the rudiments of wings. They are exceedingly active, and in general run and leap about upon the trees with great sprightliness.

The males of the perfect insects make a chirping noise, of use in alluring the females. Some naturalists suppose, that this noise is caused by the flapping of the lamellæ against the abdomen; others, by the rustling of the segments of the body in the contractile motion of that part; and Beckman, that it is caused by the beating of the body and legs against the wings. The lamellæ, on examination, do not appear to have sufficient freedom of motion to produce any such sound.

The Cicadæ of the hottest climates make the loudest noise. From the papers of Mr. Smeathman, who resided a considerable time in Africa, it appears that some are so loud, as to be heard to the distance of half a mile; and that the singing of one of them in a room, will immediately silence a whole company. Professor Thunburg says, that one of the Javanese species makes a noise as shrill and piercing, as if it proceeded from a trumpet.

Several of the species were known to the ancients, who considered them as the emblems of eternal youth. They deemed them creatures beloved both by gods and men; and indulged many poetical fictions concerning them, but particularly that they subsisted only on dew. The Athenians wore golden Cicadæ in their hair, to denote their national antiquity; or that, like these creatures, they were the first-born of the earth. Anacreon, addressing one of them, depicts, in glowing colours, the felicity which they were universally supposed to enjoy.

Happy creature! What below
Can more happy live than thou?
Seated on thy leafy throne,
(Summer weaves the verdant crown,)

Sipping o'er the pearly lawn
 The fragrant nectar of the dawn;
 Little tales thou lovest to sing,
 Tales of mirth—an insect king,
 Thine the treasures of the field,
 All thy own the seasons yield;
 Nature paints thee for the year,
 Songster to the shepherds dear:
 Innocent of placid fame,
 What of man can boast the same?
 Thine the lavish'd voice of praise,
 Harbinger of fruitful days;
 Darling of the tuneful Nine,
 Phœbus is thy sire divine;
 Phœbus to thy notes has giv'n
 Music from the spheres of heav'n;
 Happy most, as first of earth,
 All thy hours are peace and mirth;
 Cares nor pains to thee belong,
 Thou alone art ever young;
 Thine the pure immortal vein,
 Blood nor flesh thy life sustain;
 Rich in spirits, health thy feast,
 Thou'rt a demi-god at least.

THE WAX-FORMING CICADA*.

This is a singular insect, and deserves attention, both as an object of curiosity, and from its importance in domestic œconomy.

The larvæ are elegant and beautiful creatures, and to their labours the Chinese are indebted for the fine white wax, that is so much esteemed in the East Indies. They form a sort of white grease, which adheres to the branches of trees, hardens there, and becomes wax. It

* DESCRIPTION. The wing-cases of the Wax-forming Cicada are green, margined with red, and deflexed; and the interior ones are spotted with black. In the variety figured and described by Sir George Staunton, these are whitish, margined with black, and have a row of black spots on the posterior edge.

SYNONYMS. *Tettigonia limbata*. *Fabricius*.—*Cicada limbata*.

is scraped off in the autumn, melted on the fire, and strained; it is then poured into cold water, where it coagulates, and forms into cakes. In appearance, it is white and glossy; and, mixed with oil, is used to make candles, for which purpose it is considered much superior to bees-wax.

The insects are white when young, and it is then that they make their wax. When old, they are of a blackish chesnut colour, and form little pelotons on the branches of trees. These at first are each of the size of a grain of millet: towards the commencement of the spring they increase in bulk and spread; they are attached to the branches like grapes, and, at first sight, the trees that bear them appear loaded with fruit. About the beginning of May the inhabitants gather them; and, having enveloped them in the leaves of a species of broad-leaved grass, suspend them to the trees. At the end of June, and in July, the pelotons open, and the insects come forth, crawl about the leaves, and form their wax.

Sir George Staunton says of these insects, that he saw them busily employed upon the small branches of a shrub, that, in its general habit, had a considerable resemblance to privet. They did not much exceed the domestic fly in size, and were of a very singular structure. They were in every part covered with a kind of white powder: and the branches they most frequented, were entirely whitened by this substance strewed over them.

THE AMERICAN LOCUST*.

This species of Cicada is at all times common in Pennsylvania, but at certain periods (generally of four-

* **DESCRIPTION.** The body of this insect is black; and the upper wings are white, with a yellowish rib.

SYNONYMS. *Cicada septendecim.* Linn.—*Tettigonia septendecim.* Fabricius.

teen or fifteen years) the numbers are so immense, that it has obtained the general appellation of Locust.

Towards the end of April these insects emerge from the ground, and their appearance is always to be predicted by the swine searching for them. The swarms are sometimes so great, that in the places from which they have arisen, the earth appears nearly as full of holes as a honey-comb. They always leave the ground during the night. On their first coming out they are in the chrysalid state: but soon afterwards, the back bursts, and the flying insects disengage themselves from their case. For a little while they are entirely white, with red eyes, and seem very weak and tender; but, by the next day, they attain their full strength and perfection, being of a dark brown colour, with four finely variegated transparent wings.

They are very active, flying about from tree to tree with great agility. The female is directed to the male by the loud chirping noise which he makes. She lays her eggs about the end of May, piercing for this purpose the tender twigs of trees, with the dart from her tail. With this she is able to penetrate the wood in a surprisingly expeditious manner, crowding it, for the length of two or three inches, full of eggs, ranged in close lines, containing from twelve to eighteen in each. She always darts to the pith of the branch, in order that the larvæ, when they proceed from the eggs, may find food proper for their tender state. When these are full grown they drop off, and make their way into the ground, in order to prepare for a change. Here they are sometimes found at the depth of two feet or upwards.

For the sake of experiment, some of the eggs of the American Locust, about the usual time of hatching, were taken out and spread upon a table. In about an hour they cracked; and it was very entertaining to observe, how the little insects contrived to disengage themselves from the shell. When they had got clear

from all incumbrances, they run about very briskly, evidently searching for a repository in the earth.

Shortly after they have attained their perfect state, these insects always spread themselves over the country for many miles round. They are excessively voracious, and do infinite damage, in their periodical swarmings, to both orchard and forest trees; and were it not for the number and variety of their enemies, and the naturally short duration of their lives, the inhabitants would often suffer from them all the horrors of famine. It seems to have been of these insects that Mr. Hughes says, such vast swarms were bred, or came into the island of Barbadoes, in the year 1734-5, that they destroyed almost every green and tender plant. So great was the destruction they caused, and such the scarcity of food occasioned by them, particularly in the parish of St. Philip, that a collection was made for the sufferers through the rest of the island.

Domestic fowls are fond of these insects, and even some of the American squirrels become fat with them, at the times when they are very abundant. The Indians also pluck off their wings, and boil the bodies for food.

THE BLACK-HEADED FROGHOPPER*.

The larvæ or grubs of this insect are well known as discharging from their bodies, upon the branches and leaves of plants, a kind of frothy matter, called by the country-people, in many parts of England, *Cuckoo-spit*. In the midst of this they constantly reside, probably for shelter against the rapacity of such stronger insects, as would otherwise prey upon them. Nature seems to have afforded this kind of defence to the insects, as

* DESCRIPTION. This insect is of a brownish colour, and has on the upper wings two lateral whitish spots.

SYNONYMS. *Cicada spumaria*. Linn.—*Cereropsis spumaria*. Fabricius.—Cuckoo-spit or Froth-worm.

their naked and soft bodies might otherwise be easily injured; perhaps, also, the moisture of this foam may serve to screen them from the sultry beams of the sun. On removing the foam, the grub is discovered underneath; but it will not remain long uncovered. It soon emits fresh foam, that again hides it from observation.

In the midst of this foam it is, that the larva goes through its metamorphoses to a chrysalis and a winged insect. This may be observed by any person, who is careful enough to watch when the froth begins a little to subside. At this period he must put the insect with its leaf under a glass. The froth, degenerating to a white film, fixes the creature to the leaf: soon afterwards the fly may be seen first putting out its head, and then by degrees its body. As soon as the forepart is out, a small protuberance will be perceived on each side, which, every moment growing larger, will soon appear to be the wings of the fly unfolding by degrees. In about a quarter of an hour, the whole change is completed, the fly is liberated, its wings are extended over its body, and the fine silver-like case of the larva, with all its legs, and other apparatus, will be seen left behind.

This insect is very common in meadows and pastures; and is so agile, that, when attempted to be caught, it will sometimes spring to the distance of twelve or eighteen inches.

OF THE CIMECES OR BUGS IN GENERAL.

The rostrum or beak of the Cimeces or Bugs is inflected; and the antennæ are longer than the thorax. These insects have four wings, folded cross-wise, the upper ones coriaceous on the upper part. The back is flat, and the legs are formed for running.

The *larvæ* differ from the perfect insects in little else than the want of wings. Many of them infest plants, on which they live, and on which they lay their eggs.

Several of the species are voracious, and spare scarcely any other insects that they can conquer. They glut themselves with the blood of animals; destroy caterpillars, flies, and even beetles, the hardness of whose elytra would seem to be proof against all their attacks; the incautious naturalist may also himself sometimes experience the severity of their nature.

THE BED-BUG*.

The Bed Bug, which is a nauseous and troublesome inhabitant of most of the houses in large towns, is singular in having neither wings nor wing-cases. It runs about with considerable activity in the night, to suck the blood of persons that are asleep, hiding itself by day in crevices and other retired places.

It is supposed to have been first introduced to this country, in the fir timber that was brought over for the purpose of rebuilding London, after it had suffered by the great fire; for it is generally said that Bugs were not known in England before that time; and many of these insects were found almost immediately afterwards in the newly-built houses.

Their most favourite food is blood, dried paste, size, deal, beech, osier, and some other kinds of timber, the sap of which they suck; and on any of these they are able to exist. They will not feed on oak, walnut; cedar, or mahogany; for several pairs, which, for the sake of experiment, were confined with these kinds of wood, soon died, whilst those kept with the others continued to live through the whole year.

The female generally lays about fifty eggs at a time. These are white, and, when protruded, are covered with a viscous matter, which, afterwards hardening, sticks them firmly to the place where they are deposited.

* SYNONYMS. *Cimex lectularius*. Linn.—*Acanthia lectularia*. Fabricius.

These eggs are usually hatched in about three weeks. The general times of laying are March, May, July, and September: so that from every female Bug that outlives the season, as many as two hundred young-ones may be produced. Thus is the excessive increase of these nauseous animals to be accounted for, where proper care is not taken to destroy them.

The young-ones, for some time after they first escape from the egg, are perfectly white, but they generally become brown in the course of about three weeks. In eleven weeks they are at full growth. They are then very watchful and cunning creatures; and so fierce, among their own species, that they will sometimes contend with the utmost fury; and in their combats they seldom leave off till either one or both of the animals are killed. Spiders are very fond of them, and often seize them for food.

In order to clear a house of Bugs, the leading point is cleanliness in every respect; for this is their greatest annoyance, and by this alone their increase is to be checked. The first young-ones begin to burst from the eggs early in spring, frequently even in February. At this season it is, that the greatest attention is required. The bed infested by them, ought to be stripped of all its furniture, which should be washed: if linen, it should be boiled; and if stuff, it should be hotpressed. The bedstead should be taken in pieces, dusted, and washed with spirit of wine in all the joints and crevices; for it is in these parts, principally, that the females deposit their eggs. This done, all the cavities should be well filled with the best soft soap, mixed up with verdigrease and Scotch snuff. On this composition the young will immediately feed after leaving the egg, (if any escape the cleansing,) and will be destroyed, as will also such of the old ones as happen to be left.

Bugs abound in the countries of nearly all hot climates, whence most of our merchant-vessels are overrun with them. This accounts for their extreme num-

bers in all the seaport towns of this country, and particularly in the metropolis, being conveyed thither in clothes, packages, &c. Hence appears the great necessity of examining carefully every thing brought from such vessels into the houses.

Deal and beech boards should be removed, as should also every thing that is fixed to a bed by means of paste, as these afford them both shelter and food. Oak and mahogany are probably the best kinds of wood to use, as the closeness of their texture allows the animals but an uncomfortable situation.

It is supposed that Bugs do not altogether lie torpid during the winter, but that in the cold weather they require less nutriment; and therefore that they are not tempted to come so often out of their retreats, as they do in the warmer seasons of the year.

THE PARADOXICAL BUG*.

"That singular insect, the *Cimex Paradoxus*, which (says Dr. Sparrman) I have described, and of which I have given a drawing, in the Swedish Transactions, I discovered at this place, (the Cape of Good Hope,) as at noon-tide I sought for shelter among the branches of a shrub, from the intolerable heat of the sun. Though the air was now extremely still and calm, so as scarcely to have shaken an aspen leaf, yet I thought I saw a little, withered, pale, crumpled leaf, eaten as it were by caterpillars, flitting from the tree. This appeared to me so very extraordinary, that I thought it worth while suddenly to quit my verdant bower, in order to contemplate it; and I could scarcely believe my eyes, when I saw a living insect, in shape and colour resembling the fragment of a withered leaf, with the edges turned up and eaten away, as it were, by caterpillars, and at

* See Plate xix. Fig. 5.

SYNONYMS. *Cimex paradoxus*. Linn. Gmel.—*Acanthis paradoxa*. Fabricius.

the same time all over beset with prickles. Nature, by this peculiar form, has certainly extremely well defended, and concealed as it were in a mask, this insect, from birds and its other foes; in all probability with a view to its preservation, and to employ it for some important office in the system of her œconomy; a system with which we are too little acquainted, in general too little investigate, and, in every part of it, can never sufficiently admire with that respect and adoration, which we owe to the great Author of Nature, and Ruler of the Universe."

OF THE APHIDES, OR PLANT-LICE*.

The minute animals which compose this singular tribe, live entirely on vegetables, and the loftiest tree is as liable to their attacks as the most humble plant. Their numbers are often incalculably great. They prefer the young shoots, on account of their tenderness, and frequently insinuate themselves into the very hearts of the plants, doing irreparable mischief even before they are discovered. But, for the most part, they beset the foliage, and are always found on the underside of the leaf. This they prefer, not only on account of its being the most tender part, but because it affords them protection from the weather, and from various injuries to which they would otherwise be exposed. Sometimes, though rarely, the root is the object of their choice; and the roots of lettuces have been observed so thickly beset with one of the species, that a whole crop has been rendered sickly and of little value. They are rarely to be found on the bark of trees.

* The beak of the Aphides, the sheath of which is composed of five joints, is inflected. The antennæ are tapering, and longer than the thorax. These insects have either four wings, or are entirely destitute of wings. At the abdomen there are two obtuse erect horns; and the tail is sometimes terminated by a small style.

Some of the species are constantly and unalterably attached to one or more particular kinds of plants; but others feed indiscriminately on most sorts of herbage.

These insects are sometimes winged, and sometimes destitute of wings, without any distinction of sex. In the spring they are viviparous, producing their offspring alive; and in the autumn they are oviparous, depositing their eggs, like most other insects, in places where they remain secured through the winter till the ensuing spring, when they are hatched. The Aphides afford also another surprising deviation from the general laws of nature; one impregnation of the female is sufficient for nine generations.

The *larvæ*, *chrysalids*, and perfect insects, have so little difference in external appearance, that they cannot be distinguished from each other.

THE APHIS OF THE ROSE-TREE*.

Towards the beginning of February, if the weather be sufficiently warm to make the buds of the rose-tree swell and appear green, this species of *Aphis* will be found on them in considerable abundance. They are produced from small, black, oval eggs, which were deposited in autumn on the last year's shoots. If, after their appearance, the season become cold, almost the whole of them suffer, and the trees, for that year, are in a great measure freed from them.

Those that withstand the severity of the weather, seldom arrive at their full growth before April, when, after twice casting their skins, they begin to breed. It

* DESCRIPTION. This insect, which is well known by the name of *Rose Louse*, is generally of a green colour, with the tip of the antennæ and horns black. The tail is pointed, and without a style.

SYNONYMS. *Aphis Rosæ*. Linn. Gmel.—*Rose Louse*, or *Rose Aphis*.

then appears that they are *all females*: each of them produces a numerous progeny, and that without any intercourse with a male insect. The young-ones, when they first come from the parent insects, are each enveloped in a thin membrane, that has the appearance of an oval egg. This apparent egg adheres by one extremity to the mother, while the young Aphis proceeding from it, extends the other extremity; by this means gradually drawing the ruptured membrane over the head and body to the hind feet. During the operation, and for some time afterwards, the fore part of the head adheres, by the viscous matter about it, to the tail of the parent. Thus suspended, the young insect soon entirely frees itself from its former envelopement; and, when its limbs become a little strengthened, it is set down on some tender shoot, and there left to provide for itself.

In the spring months there appear but these two generations of the Aphis: the warmth of summer, however, produces no fewer than five. One of these comes forth in May; and the months of June and July supply each two more. The insects of the May breed cast their skins twice, and the others three or four times, according to the warmth of the season. When the heat has been sufficiently great, and the food is in tolerable plenty, the first change has been observed to take place in about ten days after their production.

Early in June, some of the third generation, which were produced about the middle of May, after casting their last covering, discover four erect wings, much longer than their bodies. The formation of the wings seems to depend not on sexual distinction, nor even on the original structure of the insects, so much as on the quantity and quality of the nourishment with which they are supplied. Few of those which live on succulent shoots, have wings, while those of the same generation, on the less tender branches, are most of them winged. Some time before they attain their full growth, it is easy to discern which of them will have

wings, from a remarkable fulness of the breast. When the last covering is rejected, the wings, which before were folded in a very narrow compass, gradually extend, in a most beautiful manner, to their proper size and dimensions. All the subsequent breeds are winged.

In the autumn, the eighth, ninth, and tenth generations are produced; two in August, and the last about the middle of September. The two first resemble the summer breeds, but the third differs very greatly from all the rest. Though all the Aphides which have hitherto appeared, have been females, in this tenth generation several *male* insects are found. The females have at first the appearance of the summer insects; but in a few days their colour changes from green to yellow, and gradually, before their full growth, to orange. These yellow females are destitute of wings. The males, when they first appear, are of a reddish brown, but afterwards, when they begin to thicken about the breast, they have a dark line along the middle of the back. They attain their full growth in about three weeks, and then, casting their last skin, they appear in every part, except the wings, of a bright yellow colour. They, however, shortly afterwards, become dark brown. The wings become transparent, and at length are in appearance not unlike very fine black gauze. The females soon begin to deposit their eggs, which, if possible, is always done near the buds of the branches, that the future young-ones may be the more easily supplied with nourishment. Some of them continue to lay their eggs until the beginning of November: these eggs are oval, and, when first protruded, are green, but they soon become perfectly black. They adhere to the branches on which they are deposited, by the viscous matter that at first surrounds them. These eggs remain through the winter, till the ensuing spring, before they are hatched.

If the Aphides had not many enemies, their increase in summer would sometimes be destructively great,

Among their enemies, one of the principal is a small black species of *Ichneumon* fly*, which darts its pointed tail into the bodies of the Aphides, and at the same time deposits in each an egg. This egg afterwards produces a grub, which feeds on the body of the insect till it has acquired its full growth, when it undergoes its change, and entirely destroys its living nidus.

After a mild spring, most of the species of *Aphis* become so numerous as to do considerable injury to the plants on which they are found. The best mode of remedying this evil, is to lop off the infected shoots before the insects are greatly multiplied, repeating the same operation before the time that the eggs are deposited. By the first pruning, a very numerous present increase will be prevented; and by the second, the following year's supply may, in a great measure, be cut off.

THE APHIS OF THE BEAN†.

Among the Garden Beans, a small black *Aphis* may frequently be observed, adhering to the tops in immense numbers, and afterwards gradually spreading over the whole plants. They are principally to be observed in the months of June and July; and so small and light are they, as often to be carried from one plant to another by the wind. They seldom appear until after the beans are in blossom; and, if carefully watched, it will be found that they are confined to a small extent. Dr. Anderson says, that he has seen a row of beans greatly tainted, whilst another, at the distance only of six or eight feet, had none. At the beginning, the upper leaves and the blossom are alone infected. These now appear crumpled together, and full of blackish specks.

* The *Ichneumon aphidum*, of Linnæus.

† SYNONYM. *Aphis fabæ*. Linn.

In such case, the tops should all be cut off. By this means the danger of their increase, especially in gardens, may be averted without any extraordinary degree of exertion. In fields, however, this is not so easy: in a field where they are observed, it would, perhaps, on some occasions, be found economical for the farmers of a district to contribute among themselves, so as to pay the damage that would arise to any particular person for having the whole crop of the field, in which they first began, destroyed at once, in order to prevent the insects from spreading further, and thus injuring the adjacent crops.

OF THE COCCUS, OR COCHINEAL INSECTS IN GENERAL.*

These are an extremely fertile race, and many of them are very troublesome in stoves and green-houses. The females fix themselves, and adhere almost immovably, to the roots, and sometimes to the branches, of plants. Some of them, having thus fixed themselves, lose entirely the form and appearance of insects: their bodies swell, their skin stretches and becomes smooth, and they so much resemble some of the galls or excrescences, found on plants, as by inexperienced persons to be mistaken for such. After this change, the abdomen serves only as a kind of shell or covering, under which the eggs are concealed. Others, though they are likewise thus fixed, preserve the form of insects, till they have laid their eggs and perish. A kind of down or cotton grows on their belly, which serves for the formation of the nest, in which they deposit their eggs.

* In the Cochineal insects the beak is situated on the breast; and the antennæ are thread-shaped, or of equal thickness throughout. The abdomen is terminated by four or six light-coloured bristles. The male has two erect wings, but the females have none.

The males are very different in their appearance from the females. They are furnished with wings, and are small but active insects.

Most of the species of *Coccus*, which infest our green-houses and conservatories, have been brought over, with exotic plants, from other climates.

THE LAC COCHINEAL*.

Mr. Kerr, who, in the *Philosophical Transactions*, had given a minute account of these insects, says, that he has often observed their birth, but could never see any of them with wings; nor was he ever able to remark any distinction in the sexes; owing, most probably, to the minuteness of the objects, and the want of proper glasses.

They are produced from the parents in the months of November and December. For some time they traverse the branches of the trees upon which they are produced, and then fix themselves on the succulent extremities of the young shoots. By the middle of January they are all fixed in their proper situations, and, though they now exhibit no marks of life, they appear as plump as before. The limbs, antennæ, and bristles of the tail, are no longer to be seen. Around the edges of their body they are environed with a sub-pellucid gelatinous liquid, which seems to glue them to the branch. The gradual accumulation of this liquid at length forms a complete cell for the

* **DESCRIPTION.** The head and trunk seem to form one uniform, oval, compressed, red body, consisting of twelve transverse rings, and somewhat of the shape and size of a very small louse. The back is keel-shaped, and the belly flat. The antennæ are half the length of the body, filiform, and diverging, sending off two and sometimes three diverging hairs. The tail is a little white point, from which proceed two horizontal hairs as long as the body.

SYNONYMS. *Coccus ficus*. *Linn.*—Gum Lac, in the East Indies.

insect. The insect is now, in appearance, an oval, smooth, red bag, without life, about the size of a small American Cochineal insect, emarginated at the obtuse end, and full of a beautifully red liquid.

In October and November, twenty or thirty small oval eggs, or rather young grubs, are to be found within the red fluid of the mother. When this fluid is all consumed, the young insects pierce a hole through the external covering, and walk off one by one, leaving their nidus behind. This nidus is that white membranaceous substance found in the empty shells of the Stick Lac.

These insects are found on only four different kinds of trees, the principal of which are the *Ficus religiosa* and *Ficus Indica*, of Linnæus.

They generally fix themselves in such numbers, and so close to each other, that scarcely more than one female in six has room to complete her cell: the others die, and become the food of various insects. The extreme branches of the above trees appear as if they were covered with a red dust, and their sap is frequently so much exhausted, that the adjoining parts wither away. The sap of the trees seems much allied to the cell of the Coccus, so that it appears to have undergone very little change by its formation into these cells.

These insects, which in the East Indies have the name of Gum Lac, are principally found on the trees of the uncultivated mountains on both sides of the Ganges, where nature has been so bountiful, that, were the consumption many times greater than it now is, the markets would be fully supplied. The only trouble is in breaking down the branches and carrying them to market.

In the year 1781, the price of Gum Lac, in Dacca, was only twelve shillings for the hundred pounds weight, notwithstanding its being brought from so great a distance as Assam. The best Lac is of a deep red colour. If it be pale, and pierced at the top, the value diminishes, because the insects have left their cell, and con-

sequently it can be of no use as a dye; though probably it may be of more value as a varnish.

Stick Lac is the natural state of this production. When the cells are separated from the sticks, broken into small pieces, and appear in a granulated form, they are called *Seed Lac*. This, liquified by fire and formed into cakes, is *Lump Lac*. When the cells are liquified, strained, and formed into thin, transparent laminæ, the substance has the name of *Shell Lac*.

Of *Shell Lac* the natives of Eastern countries make ornamental rings, to decorate the arms of females. They also form it into beads, necklaces, and other female ornaments. This substance was formerly used in medicine, but it is now confined principally to the making of sealing-wax, and to japanning, painting, and dyeing.

THE AMERICAN COCHINEAL*.

This Cochineal, so useful to painters and dyers, is a native of South America, where it is found on several

* DESCRIPTION. The Cochineal Insect of the Brasils is convex, with legs of a clear bright red in both male and female, and the antennæ moniliform or bead-like. The male is a delicate and beautiful insect: the colour of its whole body is bright red, nearly resembling the pigment usually called red lake; the breast is elliptical, and slightly attached to the head. The antennæ are more than half the length of the body. The legs are of a more brilliant red than the other parts. Two fine white filaments, about three times the length of the insect, project from its belly or abdomen. The wings are two, erect, of a faint straw-colour, and of a very delicate texture. The female has no wings, is elliptic in its form, and convex on both sides; but chiefly so on the back, which is covered with a white downy substance resembling the finest cotton. The abdomen is marked with transverse rugæ or furrows. The mouth is situated in the breast, having a brown beak, inclining to a purple tint, that penetrates the plant on which the insect feeds. Its six legs are of a clear bright red. *Barrow's Travels*.

SYNONYMS. *Coccus cacti*. Linn.—*La Cochenille du Nopal*, by the French.

species of Cactus, particularly the *Cactus Opuntia* or Prickly Pear-tree. In Jamaica these insects are also now tolerably common, but they are generally understood to have been introduced from America. The heavy rains, however, to which the West India islands are subject, often render the industry of the natives in breeding and rearing them entirely fruitless.

When the insects are arrived at their full growth, they adhere to the leaf of the Cactus in a torpid state: and it is at this period they are taken from the plant for use. Twice or thrice a week, the slaves appropriated to this employment go among the Cactus plants, and pick off carefully, with a bamboo twig, shaped somewhat into the form of a pen, every full-grown insect they can find, with many that have not yet attained their perfect state; the consequence of which is, that the plants are never half stocked with insects, many of the females being destroyed before they have deposited their young. The natives of Mexico pursue a method very different. As soon as the periodical rains are over, and the weather is warmer as well as drier, they fix on the prickles of the Cactus-leaves small parcels of the finest moss, serving as nests, to contain, each, ten or a dozen full-grown female insects. These, in the course of a few days, produce an innumerable tribe of young-ones, which spread themselves over the leaves and branches of the plant, till they become attached to those spots which they find most favourable for supplying nutritious juices. Here, soon acquiring their full growth, they remain motionless, and then are gathered off for use; a sufficient number being always left for the production of new broods.

The insects are converted into Cochineal, by a very simple but cruel process. The insects, which were collected in a wooden bowl, are thickly spread from thence upon a flat dish of earthenware, and placed alive over a charcoal fire, where they are slowly roasted until the downy covering disappears, and the aqueous juices are totally evaporated. During this operation, they are

continually stirred about with a tin ladle; and sometimes water is sprinkled upon them, in order to prevent absolute torrefaction, which would destroy the colour, and reduce the insect to a coal; but a little practice teaches when to remove them from the fire. They then appear like so many dark, round, reddish grains, and take the name of Cochineal; preserving so little the original form of the insect, that this precious dye was long known and sought in Europe, before naturalists had determined whether it was an animal, a vegetable, or a mineral substance.

It seems by no means improbable, that a Cochineal, more pure than that which is produced from the insect, might be prepared from some of the plants on which it feeds. There is also no reason for supposing, that we might not likewise obtain Cochineal from some of the English species, if a proper and judicious management were adopted.

It has been computed, that there are imported into Europe no less a quantity than eight hundred and eighty thousand pounds weight of Cochineal, annually.

THE EUROPEAN COCHINEAL*.

This species of Cochineal is among the various and valuable productions, with which the beneficent hand of Nature has enriched the dominions of Spain. Like other insects of the same tribe, it is found sticking to the branches and leaves of trees, particularly to those of a small species of oak about two feet high, the *Quercus coccifera* of Linnæus, that grows in Spain, Provence, Languedoc, and along the shores of the Mediterranean.

In the month of March, it is to be seen in its first state, no bigger than a grain of millet, fixed to the tree

* DESCRIPTION. The female is about the size of a pea, and of a violet colour.

SYNONYMS. *Coccus Illicis*. Linnæus.—Grana Kermes. Scarlet Grain. Dillon.—Grane d'écarlate, in France.

and scarcely able to crawl. It soon becomes immovable: at this period it increases very much in size. It now bears considerable resemblance to a vegetable excrescence, being covered with a down that adheres on all sides to the tree. Its figure is not unlike that of a small sloe. Its growth is completed in April, when it attains a round shape, and is about the size of a pea; of a reddish colour, and appearing as if filled with discoloured blood. Towards the end of May, it is seen to be full of eggs, ranged under the belly in the down that covers its body. After laying its eggs here, it soon dies, adhering still to its position, and rendering to its progeny a further service, by shielding them from the inclemency of the weather, and the hostile attacks of other insects. Each of the females will sometimes produce so many as two thousand young-ones.

The poor people of many of the provinces obtain a subsistence, by collecting these insects for sale; and, in order to pick them off the branches with greater facility, many of them suffer the nails of their fingers to grow to a great length. In some years, a sum amounting to little less than thirty thousand dollars, (five thousand pounds sterling,) has been produced to the inhabitants of one district in Spain, from the sale of this insect. But being used only as an ingredient in dyeing purple, it has been much neglected since the introduction of the American Cochineal.

THE COCCUS OR COCHINEAL OF THE PEACH-TREE*.

When the Coccus which infests the peach-tree, has attained its full growth, its whole body is filled with eggs, and on dissection it will be found, that scarcely any viscera are perceptible. The number of eggs

* DESCRIPTION. The female is of a brownish colour. Its upper surface or back is hard, like a kind of shell; and its under surface is a soft skin, on which are observable the traces of legs. A cotton-like substance appears at first all round the

sometimes amounts to three or four thousand. These are still retained under the shell of the insect, which now, beneath, assumes a concave form. The animal, after having performed, with the operation of continuing its species, all the functions that nature intended, ceases to exist. After death it remains fixed in the same place, and serves as a covering to protect the eggs, and afterwards the young brood, until their members have attained the necessary degree of strength to enable them to perform their allotted functions.

The whole brood are not hatched at one instant; but the eggs that were first laid, become first vivified. The young-ones no sooner feel their animal powers, than they begin to look about for food. At this period of their existence they are active little creatures, of an oblong shape and whitish colour; and run about every where with great celerity. They continue active only for a few days, after which they fix themselves to some tender part of the tree; in general, to the leaves or young shoots of the same year; for they are usually brought to life about the month of May. After they have thus attached themselves, they remain, without motion, under the appearance of a thin whitish scale.

The creature, however, possesses a loco-motive faculty for many months, probably all the while that it continues in its larva state. A person desirous of setting it in motion, has only to pluck off some of the leaves, on which these insects have fixed themselves,

edge, as a kind of cement, to join it there to the tree. The male is a fly, about one fourth the size of the female. It has two long antennæ, six legs, and wings which are at least twice the length of the body. The abdomen terminates in a pointed kind of tail, on each side of which there is a slender white filament, twice as long as the wings. It is of a deep red colour, except the wings, which are of a dirty white, bordered with a stripe of bright red.

SYNONYM. *Coccus Persicæ*. Linn.

and to lay them in any place to wither. So long as they remain fresh and succulent, the insects continue without motion; but when the leaves begin to shrivel, the larvæ will quit their hold, abandon the leaves, and go in search of food elsewhere. In the autumn, therefore, the insects that are attached to the leaves, change their situation for the tender and succulent parts of the bark, especially the young shoots, and still more particularly the tenderest tops of these shoots. Here they may often be found in such numbers as almost to cover the whole.

In this state they remain during the winter, still making some advances in growth. But it is not until the month of April, after they have cast their last skin, that the insects assume their perfect state. From this period the females entirely lose their loco-motive powers; and, even if the branch to which they adhere, be cut off, they will not attempt to quit it, but must inevitably perish.

The male, when it quits the larva state, is, like the others of its tribe, furnished with wings. After a short but active life, it dies without even tasting food, being apparently furnished with no organs adapted to this purpose. These flies generally appear towards the end of April or the beginning of May.

The eradication of this species from our fruit-gardens is an object of no inconsiderable importance; and, from a careful attention to their transformations and habits, it appears not to be a difficult task. If the twigs, early in the spring, were carefully brushed, in the direction of the buds, many of the insects might be detached, and thus their numbers would be greatly reduced. Where the insects are very numerous, and where, of course, they are very close together, at the points of the twigs, these points might be cut off, and carried out of the garden. If exceedingly numerous, all the young twigs might be cut out. In this case, it is true, the fruit will, in a great measure, be lost for that season; but the tree will be thrown into such

health, as to be in the finest possible order for the ensuing year. After all this has been done, however, the tree ought still to be examined about the beginning of May next season. By this time the female Coccus, having attained its greatest size, will become easily perceptible, and each of them should be carefully removed by a blunt knife, having a very thin blade, and should be carefully deposited in a vessel, for the purpose of being carried out of the garden. With each female, which is destroyed at this period, it is supposed that at least 3000 eggs are also destroyed.

THE COCCUS OR COCHINEAL OF THE APPLE-TREE*.

There is, says Dr. Anderson, in his *Recreations in Agriculture*, an insect belonging to the Coccus tribe, which has of late multiplied extremely in the nurseries about the metropolis, and which, unless carefully guarded against, threatens to be extremely destructive to our orchards. It lives upon the apple-trees, and like most of the insects of this kind, throws out such a quantity of cotton-like matter, as sometimes to cover every twig of the young trees, as if they had been rolled up in cotton.

The history of this insect is still involved in obscurity; and the changes it undergoes, and its modes of life during the various stages of its existence, are not yet distinctly known. The following particulars concerning it, are, however, related by Dr. Anderson.

Wherever this insect has fixed itself upon a tree, it communicates a corrosive ichor, that, after the insect itself is removed, affects the tree like a kind of gangrene; so that the tree becomes blotched, uneven in the bark, and full of deep holes, that soon occasion its decay and death. The insect fastens itself, by preference, upon the tender buds of young trees, immediately under the axillæ of the leaves on the shoots of that year, and

* *Coccus mali*.

very quickly infects them. It, however, takes such slight hold, that if it has not had time to bury itself in holes in the bark, it may be easily removed by means of a firm, dry painter's brush; so that the shoot shall sustain no damage from it. Rain also washes it off from smooth surfaces; and, during moist weather, a wet brush may be efficaciously employed for the same purpose.

Next to the eyes on the young shoot, this insect is found to establish itself in any cavities of the stems or larger branches of trees, which have been produced by tearing off the branches incautiously, or in any other wound in the bark. In these irregular cavities it finds a protection from rain; and from these, when the insects are once established, it is very difficult to dislodge them; so that such cavities may be considered as the nests, from which they send out swarms to spread over the young branches. It would be a great preventive against the attacks of the insects, to scoop out all such cavities to the quick; to cut off all irregular prominences; to scrape off the loose scales from the bark, and then to cover it with a composition invented by Mr. Forsyth, which would not only destroy the insects, but by bringing on a smooth, clean bark, would admit of its being afterwards washed and cleaned without difficulty.

Lepidopterous Insects*.

The present order contains only three tribes; the Butterflies, Sphinges, and Moths. These are all pro-

* The insects of the Linnean order *Lepidoptera*, have four wings, each covered with fine scales, apparently like fine powder or meal. Their bodies are composed in general of twelve membranaceous rings, which sufficiently distinguish

duced from caterpillars, by a change that is common to all the insect species. The caterpillars proceed from eggs; and the eggs of Butterflies are sometimes so numerous, that, in the spring of the year, the leaves and tenderest stems of plants are nearly covered with them.

Caterpillars are, in general, extremely voracious. Some of them eat more than double their own weight in a day, and this without suffering any inconvenience; for the digestive powers of all animals are proportioned not so much to their size, as to the duration of their lives.

They often change their skin without much altering their shape, till at last they assume a shape very different from that which they before possessed. They have now the name of *Aurelia* or *Chrysalis*; and in this state all the parts of their future form are visible, but under a thick shell: and these are so very soft and delicate, that the least touch discomposes them.

The production and manners of these animals, afford subject both of amusement and instruction.

About the middle of summer, a butterfly deposits from three to four hundred eggs on the leaf of a tree; from each of these, in a few days, a young caterpillar proceeds. The eggs of one of the species are no sooner hatched, than the young-ones begin to form a common habitation. They spin silken threads, which they attach to one edge of the leaf and extend to the other. By this operation they make the two edges of the leaf approach each other, and form a cavity resembling a hammock. In a short time the concave leaf is completely roofed with a covering of silk. Under this tent

them from all such creatures as bear the least resemblance to them. Their head is scarcely to be distinguished from the body, but by its containing an opening, in which are two jaws, each armed with a large and thick tooth. The number of their feet varies with their size and form. Along their sides are arranged holes or tracheæ, through which they breathe.

the animals live together. When not disposed to eat or to spin, they retire into their tent. It requires several of these habitations to contain the whole. As the animals increase in size, the number of their tents is augmented. But these are only temporary and partial lodgments, constructed for mutual convenience, till the caterpillars are in a condition to build one more spacious, which will be sufficient to contain the whole. After having gnawed one half of the substance of such leaves as happen to be near the end of some twig or small branch, they begin their great work. In constructing this new edifice or net, the caterpillars encrust a considerable part of the twig with white silk. In the same manner they cover two or three such leaves, as are nearest to the termination of the twig. They then spin silken coverings of greater dimensions, in which they enclose the two or three leaves together with the twig. The nest is now so spacious that it is capable of containing the whole community, every individual of which is employed in the common labour. These nests are too frequently seen in autumn upon the fruit-trees of our gardens: they are still more exposed to observation in winter, when the leaves which formerly concealed many of them are fallen. They consist of large bundles of white silk and withered leaves, without any regular or constant form. By different plain coverings, extended from the opposite side of leaves and of the twig, the internal part of the nest is divided into several different apartments. To each of these, which seem to be very irregular, there are passages, by which the caterpillars can either go out in quest of food, or retire in the evening, or during rainy weather. The silken coverings, by repeated layers, become at last so thick and strong, that they resist all the attacks of the wind, and all the injuries of the air, during eight or nine months.

About the beginning of October, or when the frost commences, the whole community shut themselves up in the nest. During the winter they remain immov-

able, and seemingly dead ; but, when exposed to heat, they soon discover symptoms of life, and begin to creep. They seldom go out of the nest till the middle or end of April. When they shut themselves up for the winter, they are very small; but, after they have fed for some days in spring, upon the young and tender leaves, they find the nest itself, and all the entrances to it, too small for the increased size of their bodies. To remedy this inconvenience, these creatures know how to enlarge both the nest and its passages, by additional operations accommodated to their present state. Into these new lodgings they retire, in order to screen themselves from the injuries of the weather, or to cast their skins. In fine, after having cast their skins several times, the period of their dispersion arrives. From the beginning to nearly the end of June, they lead a solitary life. Their social disposition is no longer felt. Each of them spins a pod of coarse brownish silk. In a few days they are changed into chrysalids, and in eighteen or twenty days more they are transformed into butterflies.

The modes adopted by caterpillars to screen themselves from observation, are as various as they are interesting. Many of them feed enclosed within the stems of herbaceous plants; others in the branches or trunks of trees; a few within fruits and the buds of flowers: some on the roots of plants; others float on the surface of the water, between the leaves of aquatic vegetables, woven around them with inimitable art; and a great number escape our notice, by taking their nourishment only in the night. And though many feed on the leaves of plants and trees in the day-time, yet some, as if conscious of the similarity of their colour to that of the undersides of the leaves, and of the safety they derive from attaching themselves thereto, are seldom to be seen but in that situation. Many of the moths, whose colours bear a resemblance to those of the trunks or branches of trees, frequently fix themselves there, and remain motionless for several hours

together. In these situations, a person unaccustomed to them, would not hesitate to pronounce them, from a little distance, the mere rugosities of the bark.

These various modes of eluding our sight, added to the uncertainty of breeding many species when procured, have prevented our being acquainted with the larvæ of the far greater number of the lepidopterous insects.

OF THE BUTTERFLIES IN GENERAL*.

These elegant insects feed on the nectar of flowers, and on the moisture which exudes from plants and trees, which they extract by means of their long proboscis or tongue. Their *caterpillars* are sometimes smooth, and sometimes thickly covered with hair; and their *chrysalids* are naked, and attached, apparently in a lifeless state, to trees, or other substances, by filaments proceeding either from the tip or the middle of their bodies.

THE LARGE WHITE BUTTERFLY†.

This is a common species, and, in its caterpillar state, is often very destructive to our cabbage and cauliflower plants. The caterpillars seem almost confined to these vegetables, on which they are generally to be found in great numbers from June to October. The butterflies first appear on wing in the middle of

* The antennæ of these insects are thicker towards the tip than in any other part, and generally end in a knob. The wings, when at rest, are erect, the upper edges meeting together over the body. They are all diurnal animals.

† **DESCRIPTION.** The general colour of this Butterfly is white, but the male differs from the female in having a few dark spots on his wings.

SYNONYMS. *Papilio Brassicæ*. Linn.—Large Garden White Butterfly. *Harvis*.

May, and, about the end of the same month, they lay their eggs in clusters on the under sides of cabbage-leaves. In a few days the caterpillars come forth, and continue to feed together till the end of June, when they are at their full growth. They then traverse about in search of some convenient place to fix themselves, where, after their change, the chrysalids may be sheltered. When such are found, they each fasten their tail by a web, and carry a strong thread of the same round their body near the head; and thus firmly secured, they hang a few hours, when the chrysalis becomes perfectly formed, and divested of the caterpillar's skin. In fourteen days after this, the butterfly is produced. The caterpillars of this latter brood attain their growth, and change to chrysalids in September, in which state they remain through the winter, till the beginning of the following May. During this time we often see them hanging under the copings of garden walls, under pales, and in other places, where they can have tolerable shelter from the inclemency of the weather.

The most effectual way of clearing cabbage and cauliflower plants of caterpillars, is to send children into the gardens, to pick them off and destroy them. This may seem a troublesome and expensive mode; but it has been found to answer, even to the extent of clearing many acres of field-cabbages.

THE PURPLE EMPEROR*.

This is the most beautiful and most interesting of all the British Butterflies. In its manners, as well as in the varying lustre of its purple plumes, says Mr.

* DESCRIPTION. The wings are indented, and of a rich brown colour, with a blue gloss, and have a whitish interrupted band on each side. On the upper part of the under wings there is an eye-like spot.

SYNONYMS. *Papilio iris*. Linn.—Le Mars. Tigny,

Haworth, it possesses the strongest claim to our attention.

It makes its appearance about the month of July, fixes its residence upon the summit of some lofty oak, from the utmost sprigs of which, in sunny days, it performs its aerial excursions. "In these," continues this writer, "he ascends to a much greater elevation than any insect I have ever seen; sometimes mounting even higher than the eye can follow, especially if he happen to quarrel with *another Emperor*, the monarch of some neighbouring oak. These insects never meet without a battle, flying upward all the while, and combating furiously with each other: after which they frequently return to the identical sprigs from which they each ascended.

"The Purple Emperor commences his aerial movements from ten till twelve o'clock in the morning, but does not perform his loftiest flights till noon; decreasing them, after this hour, until he ceases to fly, about four in the afternoon."

The females, like those of many other species, are rarely seen on wing. The reason of this is their being destitute of a certain *spiral socket*, which the males possess, near the base of the main tendon of their upper wings. This socket receives and works a strong elastic *spring*, which rises from the base of the under wings, and thereby enables them to perform a stronger, longer, and more easy flight than it is possible for the females to do.

The males, as before stated, usually fly very high, and are only to be caught by means of a bag-net, fixed to the end of a rod twenty or thirty feet long. There have been instances, though they are rare, of their settling on the ground near puddles of water, and being taken there. When the Purple Emperor is within reach, no insect is more easily caught; for he is so bold and fearless, that he will not move from his settling place, until quite pushed off.

The caterpillar is green, with oblique white lines.

It is rough on the upper part of the body; and on the head there are two spines. It feeds on the oak. The chrysalis is green, has two horns, and is somewhat compressed.

THE PEACOCK BUTTERFLY*.

The caterpillars of this Butterfly are produced from eggs, which have been deposited in the spring of the year on the nettle. They live in society, and are to be found, throughout the early part of the summer, feeding on this plant. They are black, and their bodies are covered with spines, and marked with numerous small white specks.

Shortly after the little animals first see the light, they begin to spin for themselves a large and commodious web, into which they flee for shelter during rainy weather, and in the night; and under the protection of which they change their skins.

When they have attained their full growth, they seek out some proper place where they can safely take their chrysalid form. In doing this they suspend themselves vertically, with the head downward; and the chrysalis, thus suspended, continues for about twenty days, about the end of which time the insect becomes perfected, breaks out from its shell, and flies away.

In the south of England the Peacock Butterfly is sufficiently common; but it is extremely rare in the north. In the county of York it is not known to have been more than twice caught. During the winter it conceals itself, and it does not die until after it has deposited its eggs in the ensuing spring.

* DESCRIPTION. The wings are angular and indented, of a brownish red colour, with black spots. There is a large blue eye-like spot on each; and on each of the upper wings there are two black spots.

SYNONYMS. *Papilio Io*. Linn.—*Le Papillon Paon* du Jour. Tigny.

THE MARSH FRITILLARY*.

The caterpillars of this insect are to be seen, in some particular situations, in September, in great abundance. They keep together under the cover of a fine web, which they spin to defend themselves from the inclemency of the weather; and under the protection of this, they pass the winter months. During this time they are so nearly reduced to a torpid state, as to require no food, nor do they venture out of their general covering, till they are invited by the warmth of the spring. As they afterwards increase in size, they go abroad in search of food; but their local attachment is very remarkable; for neither the caterpillar, nor even the butterfly, will stray far from the place where it was bred. Numbers of the latter may sometimes be observed on wing, in a small spot of swampy or marsh land, when not one of them is to be met with in any of the adjacent places. As they fly very low, and frequently settle, the naturalist has no difficulty in catching them. The caterpillars are generally at their full growth about the last week in April. They now suspend themselves by the tail to change into chrysalids, and in this state they remain about fourteen days. Their mode of suspension is a singular instance of the extraordinary power of instinct. They first draw two or three small blades of grass across towards their top, and fasten them together by means of their silk; then hang them-

* **DESCRIPTION.** The Marsh Fritillary is a small butterfly, not measuring more than an inch and a half across the broadest part of its expanded wings. Its colour is a brownish orange, variegated with yellow and black, in a small pattern. The under sides of the wings are lighter, and chiefly orange and yellow. It is sometimes called Greasy or Dishclout Fritillary, from these under sides having always a greasy appearance.

SYNONYMS. *Papilio artemis.* *Fabricius.*—Greasy Fritillary, or Dishclout. *Harris.* *Haworth.*—Marsh Fritillary. *Lewin.*

selves beneath the centre of these, each having his own little canopy. By this means they are not only hidden from the sight of birds, but in a great measure defended from the injury, which they might otherwise sustain from windy and boisterous weather. They feed on the Devil's-bit Scabious, (*Scabiosa succisa*,) and on various kinds of the marsh grasses; eating only the opening leaves as they come up. Hence it is sometimes difficult to find them. Their time of feeding is only while the sun shines; for if, whilst in the very act, the sun becomes hidden by a cloud, they immediately cease; but, on the return of the sun-beams, they recommence their operations.

If any person wish to observe the operations and change of these caterpillars, at his own home, he has nothing more to do, than to cut a turf from the place where they are found, and they will feed as readily in confinement as they did in the fields.

THE NETTLE TORTOISE-SHELL BUTTERFLY*.

These Butterflies make their earliest appearance, in a winged state, about the month of April. They are short-lived, laying their eggs in the beginning of the following month, on the uppermost stalks of nettles, and dying very shortly afterwards.

The eggs adhere by means of the glutinous mois-

* DESCRIPTION. The upper wings of this well-known insect, one of the most beautiful and most common of the British Butterflies, are red, and marked with alternate bands of black and pale orange; below these are three black spots, the inner one of which is square; and near the extremity of the upper parts is a white stripe. The lower wings also are red, marked with a large black patch at the base. The margins of all of them are black, with blue spots.

SYNONYMS. *Papilio Urticæ*. Linn.—Nettle Tortoise-shell. *Lewin*.—Tortoise-shell Fly. *Harris*.—Small Tortoise-shell. *Haworth*.

ture, with which they are covered when first protruded. About the middle of the month, the young caterpillars may be seen of a light green colour, on the nettle-tops, enclosed in a web that covers the whole upper part of the plant; and in this they all herd together. They soon cast their first skin, when they always remove to a fresh place, leaving their old coverings hanging to the web. Here, at a little distance from their former habitation, they form a new colony. In their third skin they make another remove, but still keep together in a web. On changing this they also change their colour, and become black; and as they have now increased too much in size to live in one society, they separate into companies. In their sixth or last skin, they entirely separate; and in this state they often make such ravages among the nettles, as to leave nothing but the stalks and fibres. Sometimes they are seen so numerous, as to cover all the tops, and six or seven inches of the stalks, giving them the appearance of being enveloped in a black cloth.

About the beginning of June they attain their full growth; when, fastening their tails by a web under the nettle-leaves, or to the stalks, they change into chrysalids. These are at first green, but in a day or two they change to a bright gold, or to a green brown colour. They remain thus for about twenty days, when they become Butterflies. Some few of this second brood live through the winter, being frequently found during that season in a state nearly torpid.

These insects, soon after their enlargement from the chrysalid state, discharge a few drops of reddish fluid, which, in places where they have been in great numbers, have had the appearance of a *shower of blood*, and been recorded by writers as the forerunner of some extraordinary event. The first discovery of this circumstance, that has been recorded, is related by M. de Reaumur. He says, that in the beginning of July, 1608, the people of the town of Aix were in the utmost alarm, from what they thought a shower of blood, that

had just fallen in the suburbs, and for some miles round the place. M. de Peiresc, a philosopher, who, among other kinds of knowledge, had not neglected that of the operations and economy of insects, was consulted on the subject. He found the walls of a church-yard near the place, and the walls of several small villages in the neighbourhood, to be spotted with large drops of a blood-coloured liquid. A little time before this, he had happened to pick up a large and beautiful chrysalis, which he had carefully laid in a box. Immediately after its transformation into the butterfly state, he remarked that it had left a large drop of blood-coloured liquor on the bottom of the box. The red stains on the walls, on stones near the highways, and in the fields, were found to be perfectly similar to that left on the bottom of the box. M. de Peiresc now no longer hesitated to pronounce, that all those blood-coloured stains, wherever they appeared, proceeded from the same cause. The prodigious number of butterflies, which he, at the same time, saw flying in the air, confirmed his original idea. He likewise observed that the drops of the miraculous rain were never found in the middle of the town; that they appeared only in places bordering upon the country; and that they never fell upon the tops of houses, or upon walls more elevated than the height to which butterflies generally rise. What M. de Peiresc himself saw, he showed to many persons of knowledge or of curiosity, and established, as an incontestable fact, that the pretended drops of blood were in reality but drops of a red liquid deposited there by butterflies. It is also deserving of remark, that all the showers of blood, that have been recorded to have happened, took place in the warm seasons of the year, when the butterflies are most numerous.

OF THE SPHINGES OR HAWKMOTHS*.

The bodies of these insects are usually thick and heavy, and their wings long and admirably calculated for rapid flight. Some of them are among the largest of the Lepidopterous Insects. They fly, for the most part, early in the morning, and late in the evening. They hover over flowers, and, without settling upon them, suck out the nectarious juices by means of their long and spiral tongue.

Their caterpillars are large, smooth, and without hairs, and furnished with a single erect horn near their posterior extremity. The greater number of the species change into chrysalids under the surface of the ground.

THE DEATH'S HEAD HAWKMOTH †.

The name of this Moth has been obtained from its having upon the thorax somewhat the appearance of a human skull. It is the largest of all the British species, the wings of the females measuring sometimes more than five inches in extent.

When taken into the hand, this Moth makes a singular kind of noise, by striking its palpi against the tongue. This, by some persons, has been compared to the plaintive squeaking of a mouse.

The Death's-head Hawkmoths generally make their

* The antennæ of these insects are of a somewhat prismatic shape, tapering at each end. The tongue, in most of the species, is exserted. There are two feelers. The wings are in general deflected.

† DESCRIPTION. The wings are entire; the lower ones yellowish, with two brown bands. The abdomen is yellowish, with black belts; and on the thorax there is a mark, bearing a fanciful resemblance to a human skull.

SYNONYMS. *Sphinx atropos*. Linn.—*Le Sphinx tête de Mort*. Tigny.

first appearance about the end of September, or the beginning of October: they fly abroad only in the evening, and again at break of day. During one year, in which the inhabitants of Bretagne suffered dreadfully from an epidemic disease, moths of this description were observed in immense numbers. The people, terrified by the singular appearance of their thorax, immediately attributed their sufferings to the visitation of these insects. And the plaintive cry of the insects when taken up, tended greatly to confirm this error.

These Moths generally deposit their eggs on the potatoe-plants. The caterpillars, when full grown, are of immense size, sometimes more than three inches in length, and of the thickness of a man's finger; yet they are seldom to be observed, from their either returning under the ground, or artfully concealing themselves beneath the leaves in the day-time, and coming abroad only in the evenings to feed.

Several persons have attempted to feed the caterpillars, for the purpose of obtaining specimens of the insect in its perfect state. But although they have diligently attended to them, and the insects have completed their transformation into chrysalids, I have not yet heard of any one, who was able to rear them up to the winged state. I have myself made numerous attempts, but have invariably failed. "Perhaps," says Mr. Haworth, "in a state of nature, they may perform their metamorphoses deeper in the ground, and consequently, in a more moist and equal temperature, than that required by most other Lepidopterous Insects; and if so, the cause of their perishing in our-breeding-cages, is owing to their having, in those cages, too scanty and too dry a soil."

OF THE MOTHS IN GENERAL*.

The Moths are only to be seen flying abroad in the evening and during the night, which are their times of feeding. The larvæ or *caterpillars* are in general smooth, and more or less cylindrical: they are active creatures, and prey with great voracity on the leaves of plants. Their *chrysalids* are either concealed in the ground, or protected from the inclemency of the weather by a silky covering, spun by the larvæ around their bodies. In this state they are either simple, or have a kind of hook at their extremity.

THE SILKWORM†.

The Silkworm is found, in a native state, on mulberry-trees, in China and some other eastern countries, whence, in the reign of the emperor Justinian, it was originally introduced into Europe. It is, however, at this time become, in a commercial view, one of the most valuable of all insects; affording those delicate and beautiful threads, that are afterwards woven into silk, and manufactured into garments in almost all parts of the world.

In the warmer climates of the east, the Silkworms are left at liberty upon the trees; where they are hatched, and on which they form their cocoons: but in cooler countries, where these animals have been introduced, they are kept in a room with a south aspect, built for the purpose, and are fed every day with fresh leaves.

* The antennæ gradually taper from the base to the tip. The tongue is spiral, and the wings, when the animals are at rest, are generally deflected.

† See Plate xviii. Fig. 8, 9, 10, 11.

SYNONYMS. *Phalæna* (bombyx) *mori*. Linn.—*Bombyx mori*. Fabricius.

The eggs are of a straw-colour, and each about the size of a pin's head. At its birth the larva or worm is entirely black, and about as long as a small ant; and it retains this colour eight or nine days. The worms are put on wicker shelves, covered first with paper, and on this with a bed of the most tender of the mulberry-leaves. Several ranges are placed in the same chamber, one above another, about a foot and a half apart. The scaffolding for these ranges should, however, be in the middle of the room, and the shelves not too deep. The worm continues feeding during eight days after its birth, when it becomes about the fourth of an inch in length: it then experiences a kind of lethargic sleep for three days, during which it casts its skin. It now feeds for about five days, and is considerably increased in size, when a second sickness comes on. In the next ten days it experiences two other attacks; by which time it has attained its full growth, and is somewhat more than an inch in length, and two lines in thickness. It then feeds during five days, with a most voracious appetite; after which it refuses food, becomes transparent, with a tinge of yellow, and leaves its silky traces on the leaves that it passes over. These signs denote that it is ready to begin the cocoon, in which it is to undergo its change into a chrysalis. The animals are then furnished with little bushes of heath or broom, stuck upright between the shelves; they climb up the twigs, where, after a little while, they begin the foundation of their lodge, and are five days in spinning the cocoon. They generally remain in this state about forty-seven days.

The retreat which they thus form, is a cone or ball of silk, spun from two longish bags, that lie above the intestines, and are filled with a gummy fluid of a marigold colour. The apparatus, with which the animal is furnished for spinning the silky threads, that principally compose this bag, resembles, in some measure, a wire-drawer's machine, in which gold or silver threads are drawn to any degree of fineness; and through this the

animal draws its thread. As every thread proceeds from two gum-bags, it is probable that each supplies its own; they, however, are united as they proceed from the animal's body. If we examine the thread with a microscope, it will be found flattened on one side, and grooved along its whole length. Hence we may infer, that it is doubled just upon its leaving the body, and that the two threads stick to each other by the gummy quality they possess.

In a state of nature, the Silkworm, previously to the spinning of its web, seeks out some convenient place to erect its cell without obstruction. When it has found a leaf, or a chink, fitted to its purpose, it begins to writhe its head in every direction, and fastens its threads on every side to the walls of its retreat. These, being continued, form at length the little oval ball, in which it is to undergo its change.

The exterior of the cocoon is composed of a kind of rough cotton-like substance, called floss; within this the thread is more distinct and even; and next to the body of the aurelia, the apartment seems lined with a substance of the hardness of paper, but of a much stronger consistence. The thread which composes the cocoon, is not rolled regularly round, but lies upon it in a very irregular manner, and winds off first from one side, and then from the other.

In the course of six or seven days, all the cocoons are generally formed: they are then taken from places where they had been deposited, and divided into classes. The best are strong, and of a pure, unspotted colour. Some are white, and others yellow. The good ones are firm and sound, of a fine grain, and have both ends round and strong. Those of a bright yellow yield more silk than the others. But the pale ones are preferred, because they take certain colours better, and because, since they contain less gum than the others, they lose less than those in boiling.

Five or six days after the cocoon has been detached, the birth of the moth is prevented, as the insect would

otherwise pierce the shell, and thereby render the cocoon useless. To prevent this, the cocoons are put into long, shallow baskets, covered up, and baked for about an hour, in a heat equal to that of an oven from which the bread is just drawn.

After the baking, they are disposed in a proper manner on osier shelves, distributed into stories, two or three feet distant from each other.

The whole thread, if measured, will be found about three hundred yards long; and it is so fine, that eight or ten threads are generally rolled off into one. For this purpose the cocoons are put into small coppers or basins of water, each over a small fire. The ends of the threads are found by brushing them over gently with a whisk made for the purpose; and, in the winding, they are each passed through a hole, in an horizontal bar of iron placed at the edge of the basin, which prevents them from becoming entangled.

A fortnight or three weeks generally elapse before the insect within the cocoon is changed into a moth; but no sooner is it completely formed, than, having divested itself of its aurelia skin, it prepares to burst through its prison. For this purpose it extends its head towards the point of the cocoon, and gnaws a passage through its cell, small at first, but enlarging as the animal increases its efforts for emancipation. The tattered remnants of its aurelia skin are left in confusion within the cocoon, like a little bundle of dirty linen.

The animal, thus set free, appears exhausted with fatigue, and seems produced for no other purpose than to transmit a future brood. The male dies immediately after its conjunction with the female; and she only survives him, till she has laid her eggs, which are to be hatched into worms in the ensuing spring.

In many parts of Italy, the inhabitants contrive to have two silk-harvests in the year. They keep the eggs in very cool places; and, when the mulberry-trees (after having been stripped entirely of their leaves for

former worms) begin to bud a second time, they expose the eggs to be hatched.

During the whole time in which the animals continue in a worm state, the utmost care and attention are requisite, as they are extremely susceptible of cold, dampness, and unpleasant smells.

THE GOAT MOTH*.

The Caterpillar of this moth inhabits the interior of decayed trees, particularly that of the willow and poplar, and continues in this state for three years, before it undergoes its change to a chrysalis. The parent moth deposits her eggs on the bark of the tree; and the larva, as soon as it is hatched, gnaws its way, through the bark, into the interior. Its jaws are extremely powerful.

This is one of the species of Lepidopterous Insects, which possess properties injurious to mankind during the larva state. They do considerable damage by their boring, in various directions, into the trunks of young willow trees, and there feeding upon the wood and pith; often weakening the tree so much as to cause its easy overthrow by the first storm that afterwards occurs.

In this state they have a strong and disagreeable odour, occasioned by an oily liquid, which they emit from their mouth. It is supposed that this liquid is of use in moistening the wood, and thus preparing it for the operation of the insect's jaws.

The insect changes into a chrysalis in the interior

* DESCRIPTION. The wings of this moth are of a deep and clouded grey-colour, marked with a great number of small blackish waves. The thorax has an angulated band of black on its posterior part.

SYNONYMS. *Phalæna (bombyx) cossus*. Linn.—*Bombyx cossus*. Haworth.—*Cossus ligniperda*. Fab.—*La Rongeuse de Bois*. Cuvier.

of the tree; where it spins a nidus of loose texture, composed of the saw-dust of the tree, mixed with the silk which it produces from its own body. In this state it continues about forty days, before it is perfected.

Mr. Haworth, in his *Lepidoptera Britannica*, states, that, probably, the best mode of preventing the mischief occasioned by these insects, would be to search for and destroy the sluggish females, at the end of June; since, from their large size, they would readily be found sticking upon the trees near the infected parts.

THE BROWN-TAIL MOTH*.

In the years 1780, 1781, and 1782, the attention of the public was strongly excited by the unusual appearance of infinite numbers of large white webs, containing caterpillars, which were conspicuous on almost every hedge, tree, and shrub, in the vicinity of London. Much alarm was excited in the minds of the superstitious, the weak, and the timid. Many persons, absurdly enough, supposed them to be a presage of the plague; and others asserted that their numbers were so great, that they would render the air pestilential, and would destroy every kind of vegetable, and starve the cattle in the fields. Some idea may be formed of their numbers, from the statement made by Mr. Curtis, in his *History* of this insect, that, in one day, four-score bushels of them were collected, for the purpose of being burnt, in the parish of Clapham. They chiefly abound-

* DESCRIPTION. The wings of this Moth are white. The rays of the antennæ are ferruginous; and the abdomen is terminated with brown hairs.

SYNONYMS. *Phalæna* (bombyx) *phæorrhæus*. *Bombyx phæorrhæus*. *Haworth*.—Brown-tail Moth. *Curtis's Short History of the Brown-tail Moth*.

ed on the hawthorn, the oak, elm, black-thorn, rose-trees, brambles, and fruit-trees.

These moths issue from the chrysalis about the beginning of July, at which time they may be found flying about slowly, especially in the evening, and depositing their eggs on the foliage of the above-mentioned trees and shrubs. The caterpillars are hatched early in the autumn. As soon as they have quitted the egg, they set about spinning a web; and having formed a small one, they proceed to feed on the foliage, by eating the upper surface of the leaf, and leaving only the underside and ribs. It is curious to observe with what regularity they marshal themselves for this purpose. Thus they proceed, daily spinning and enlarging their web, into which they always retreat at night, and in bad weather, for shelter and protection. In a few weeks, their operations begin to be visible on the trees.

At this period, the insects are easily destroyed, as the entire nest may at once be cut off with a pruning knife, a sharp hook, or a pair of gardener's shears. And it is stated, that no remedy short of the actual removing of the webs, and burning or crushing the insects, will avail. Lotions, fumigations, and various kinds of vermin-powder, have been applied, but to no purpose. They are too strongly enveloped in their webs to be affected by any of these.

In about three weeks from their being hatched, the caterpillars change their skins; a process which they undergo four or five times, at different periods of their growth. This usually occupies several days. Afterwards they proceed, as before, enlarging their web, and extending their daily foraging excursions, until the winter comes on, when they are confined entirely to their silken habitation. They now not only secure the general web on all sides as strongly as they can, but each individual spins a case for itself. Here they rest in a state of torpid security, until the genial warmth of spring animates them afresh, and informs them that

the all-bountiful Author of Nature hath provided the "food convenient for them." Thus apprized, they issue forth in the day-time, and in fine weather, as before; but having acquired stronger powers, and the foliage they now have to encounter being more tender, they become less scrupulous in their feeding, and devour the whole of it.

A disposition to associate, usually continues with them, until they have changed their last skins, when they separate, each endeavouring to provide, in the best manner it is able, for itself. A few of them, however, are sometimes found continuing together to the last, when each spins a separate web, in which it changes to a chrysalis. This usually takes place about the beginning of June. Here, in a state of perfect quietude, it remains about three weeks, until it undergoes its final change.

These insects are so common in England, as to be found, every year, in considerable abundance; but the cause of the unusual increase of them in the years above-mentioned, cannot satisfactorily be accounted for, and will, perhaps, be for ever concealed from our knowledge.

THE BARRED TREE LACKY MOTH*.

Towards the conclusion of autumn, and before the fall of the leaf, the females of this species deposit their eggs, in a very beautiful ring, round the tender twigs of apple-trees. These eggs are arranged in fifteen or twenty spiral rows, in close and symmetrical contact. They are hatched in the spring, as soon as the leaves

* DESCRIPTION. The thorax and wings are somewhat of a buff-colour. The upper wings have two ferruginous streaks. The caterpillars are glaucous, with a white line down the back, and three red ones on the sides.

SYNONYMS. *Phalæna (bombyx) neustria*. Linn.—*Bombyx neustrius*. Haworth.—*La Livrée*. Cuvier.

appear. The young-ones do not separate, but live in one society, and form for themselves one common web, which they enlarge from time to time, as their necessities require.

These caterpillars are very destructive to fruit-trees ; which are sometimes quite defoliated by them, and covered over with their webs, contracting thereby a sickly and unpleasant appearance. The best mode of destroying them is stated to be by shaking the branches violently, either with the hand, or with a pole having a hook to it. This brings them quickly to the ground, where they may easily be destroyed.

As soon as the Caterpillar has attained its full growth, towards the end of the spring, it spins, between two leaves, a nidus of whitish silk, of an elongated form, and covered with a yellowish kind of powder. Within this it changes to a chrysalis, and, about twenty days afterwards, to a perfect Moth.

THE CLOTHES MOTH*.

The larva of this little Moth is well known from the damage it commits in woollen cloth and furs. These substances constitute the principal support of the caterpillar, and therefore the parent is, by its natural instinct, directed to deposit its eggs in them. The caterpillar, as soon as it quits the egg, begins to form for itself a nest: for this purpose, after having spun a fine coating of silk immediately around its body, it cuts the filaments, of the wool or fur, close to the thread of the cloth, or to the skin. This operation is performed by its jaws, which act in the manner of scissors. The pieces are cut into convenient lengths, and applied, with great dexterity, one by one, to the outside of its case; and to this it fastens them by means of its silk. Its

* SYNONYMS. *Phalaena (tinea) sarcitella*. Linn.—*Tinea sarcitella*. Fabricius. Haworth.—*La Teigne fripière*. Tny.

covering being thus formed, the little caterpillar never quits it but in the most urgent necessity. When it wants to feed, it puts out its head at either end of its case, as best suits its convenience. When it wishes to change its place, it puts out its head, and its six fore-legs, by means of which it moves forward, taking care first to fix its hind legs into the inside of the case, so as to drag it along.

It lives in this manner, until, by the augmentation of its size, its case becomes too small for the body. When this is felt, it begins by making a small addition to one end; then, turning itself within the case, which, in the middle, is always wide enough for that purpose, it makes a little addition to the other end, so as still to preserve the widest part exactly in the middle; and in similar manner it makes every successive addition.

The progress of its operations may be easily remarked, by transferring it from cloth of one colour to that of another. In this case every fresh addition will become conspicuous, by forming a small ring of their respective colours at each end, as they are used.

When the case wants widening, the insect, with its scissor-like teeth, begins by making a slit lengthways, from the centre to one of the extremities. This opening it instantly fills up with a thin stripe of wool externally, and silk internally, in the same manner as in the other parts. It afterwards, at a little distance from this, makes another slit at the same end, which it also fills up; then turning itself within, it repeats the same process from the centre to the other end.

After having changed within its case into a chrysalis, it issues, in about three weeks, a small winged nocturnal Moth, of silvery-gray colour, well known to almost every mistress of a family.

It may be useful to point out the best modes of preventing the havoc, which these insects commit in our wardrobes and furniture. The smell of oil of turpentine is instantaneous death to them; if, therefore, the goods affected by them be put into a close place, along

with a saucer or other open vessel containing oil of turpentine, the warm air raising the vapour will immediately destroy them. Sometimes, if the caterpillars be old and strong, it may be necessary to brush the clothes with a brush, the points of which have been dipped in the turpentine. The smoke of tobacco also kills them; and cloth that has been steeped in a decoction of tobacco-leaves, will never afterwards be affected by them.

THE SERATELLA MOTH*.

In the month of May, the leaves of the pear, and sometimes of the apple and plum trees, may be remarked to have upon them several small, downy, and fawn-coloured cylinders, which are of a substance apparently very different from that of the leaf. The base of each cylinder is formed into a small protuberance, on which it is capable of being moved backward and forward on the leaf, without destroying its adherence.

If the cylinder be greatly compressed with the fingers, a small yellowish caterpillar, with a black head, will be observed to protrude itself, and may be entirely disengaged from its nidus by a fine needle. The habitation or cylinder of this caterpillar is composed of a kind of woolly substance, which the little creature spins out of its own mouth. At the first hatching of the caterpillar, this habitation is small; but as soon as it becomes too confined, the animal divides it lengthwise, by means of its jaws, and closes up the cleft with new

* DESCRIPTION. This is a small nocturnal Moth, of a brownish colour, marked with numerous black dots and stripes on the upper wings, which are beautifully fringed in the middle. The under wings are very small, and fringed at the margin. The hind legs are nearly twice the length of the body, and fringed at their articulations.

SYNONYM. *Phalæna (tinea) seratella*. Linn.

materials. The insect, when stretched to its full length, is much longer than its cell; but it is easily able to accommodate itself to this, as it has the power of contracting itself to nearly half its greatest length.

Whenever the caterpillar is desirous of changing its situation, it gnaws asunder the few threads, which secure it by the protuberance at the base of its cell, and then crawls (with the cell adhering to the hinder part of its body) to another part of the leaf, and there forms a new attachment. By this means the protuberance continually receives additions of new substance.

In feeding, the caterpillar brings down its head to the leaf, and it devours so much of the external rind as lies within the circumference of a circle formed by its own body and cell as a radius. When the produce of this little area is consumed, it gnaws through the cords of its tent, and pursues its journey to a fresh spot. Here again it fixes itself, until a necessity for further removal occurs.

After having made three or four of these migrations, the little animal is prepared for its change. At what period it undergoes its first change, has not been exactly ascertained; but it is probably about fourteen days after the caterpillar is hatched. It becomes a chrysalis before it quits its cell, and probably continues in this state about ten days.

If, in the months of May or June, we beat a gooseberry bush, swarms of these Moths issue forth. Their flight, in the day-time, is by jerks; and they do not fly far at a time, but seek to conceal themselves amongst the leaves of the nearest bush.

The females do not deposit their eggs in clusters, like most other insects, but singly; and they seldom deposit more than one upon the same leaf.

So small are these insects, that they appear to have eluded the observation of most naturalists in this country; yet their numbers are sometimes such, that they commit great devastation in our orchards. The effect has been long felt, though the cause was unknown, and

consequently no remedy has been applied. In some years the leaves of pear-trees have been so infected with the *Seratella* Moths, that they have all fallen off, and have left the trees nearly as naked as at Christmas, so that no fruit could be obtained from them.

As these Moths are very inactive in the day, Dr. Anderson, in his *Recreations in Agriculture*, recommends, about the time when they become perfected, to squirt water upon the trees by means of a garden-engine; thus to beat them down, and then either to bury them in the ground, or carefully to pick them up and destroy them. The operation should be repeated every morning, as long as one of them can be discovered. By taking them thus, they will not have time to deposit their eggs; so that, at all events, their numbers will be greatly reduced; and, if the operation be continued with perseverance, they will in the end be completely exterminated.



Neuropterous Insects*.

OF THE LIBELLULÆ, OR DRAGON-FLIES†.

Few of the insect tribes are more beautiful than these. Their colours are various and brilliant: we observe in them green, blue, crimson, scarlet, and

* The insects of the Linnean order *Neuroptera* have four membranaceous, transparent, naked wings, in which the membranes cross each other so as to appear like net-work. The tail has no sting, but, in the males of many individuals, is furnished with appendices like pincers.

† The mouth of the Dragon-fly is armed with jaws, generally more than two in number. The antennæ are very thin, of equal thickness throughout, and shorter than the thorax.
"The expanded, and the tail of the male insect is a forked process.

white; and even in some individuals, most, if not all, of these colours are blended. In addition to the beauty of their colours, the brilliancy of their eyes, and the delicate texture and wide expansion of their wings, are highly deserving of notice and admiration.

They are an extremely ravenous tribe, eagerly seizing and devouring all kinds of their fellow-insects. From their cloven tail, the common people of many parts of England entertain a notion that they are furnished with a sting; hence they are sometimes known by the name of *Horse-stingers*. This notion is, however, entirely erroneous.

The parent insects deposit their eggs on the surface of the water. Thence they sink to the bottom, where, in due time, they are hatched. The *larvæ*, which proceed from these eggs, are active inhabitants of the water; and, furnished with forcipated jaws, they prey with the most rapacious ferocity on aquatic insects. The *chrysalis* resembles the larva in every respect, except in having the rudiments of wings.

In both these primary states the insects respire water, by receiving and ejecting it at an aperture at the termination of their bodies. They are occasionally observed to throw out water with such force, that the stream is perceptible to the distance of two or three inches from their bodies. If they be kept some time out of water, the desire or necessity of respiration is augmented: and accordingly, when replaced in a vessel filled with water, the inspirations and respirations are repeated with unusual force and frequency. If one of them be held in the hand, and drops of water be applied to the posterior end of its body, it instantly, by an apparatus somewhat similar to the piston of a pump, sucks in the water, and the dimensions of its body are visibly augmented. This water is again quickly thrown out by the same instrument. But though the insect thus respire the water, air seems to be not the less necessary to its existence: for, like other insects, the whole interior part of its body is amply furnished with

large and convoluted breathing-pipes; and, externally, there are several small openings destined for the introduction of air.

THE GREAT DRAGON-FLY*.

This, in its perfect state, is one of the most brilliant of the British species, and affords a singular instance of the wonderful diversity of form and manners between the larva and complete states of the same animal.

The parent insect, towards the end of May, when ready to deposit her eggs, seeks the warm and sheltered sides of ponds or ditches. She drops them on the surface, hovering at the same time up and down just above. The eggs immediately sink to the bottom, and, after a little while, are hatched into larvæ of a dirty brown colour, with six legs. These are excessively voracious, and destroy with their forcipated jaws multitudes of small water-insects. This formidable apparatus is so constructed as to fold over the face when at rest, and to be suddenly thrown forwards, when in action, to a considerable extent. The chrysalis differs from the larva only in exhibiting the rudiments of future wings, which are enveloped in short cases or processes, on the back of the animal. After remaining in this state about two years, the animal ascends the stem of some water-plant, and sitting some time in the sunshine, gives life to the insect in its perfect or ultimate form. This generally so disengages itself from the skin of the chrysalis, that it leaves it in exactly its former appearance on the stem. "About the beginning of May," says Mr.

* DESCRIPTION. The length of this insect is about four inches, and it is of proportionate thickness. The eyes are blue and large. The thorax is variegated with green, yellow, and black; and the abdomen generally with blue and black; but the colours vary considerably.

SYNONYMS. *Libellula grandis*. Linn.—*Æshna grandis*. Fabricius —*La Libellule grande*. Tigny.—Great *Libellula*. Variegated *Libellula*.

Bartram, in the Philosophical Transactions, "I observed many deformed water-insects, called *Hexapodes*, creep out of the water and fix on shrubs and rushes. In this situation they continued but a few hours before their backs split open, and from the deformed creatures sprung out beautiful flies with bright shining wings, all of which, in less than an hour afterwards, attained their complete dimensions." At the first exclusion of the insect, the wings are weak and tender, and folded into a very narrow compass. During their unfolding, and till they become perfectly dry, it continues almost motionless; but they are no sooner completed, than the little animal commences an inhabitant of the air, and would now be as effectually destroyed by continual submersion under water, as the larva would before have been by exposure to the air.

In their complete state, the Dragon-flies, as I have already remarked, feed on the smaller insects; and they are also remarkable for the vigour and celerity of their flight. The Rev. Revett Sheppard informs me, that, in the summer of 1801, he sat for some time by the side of a pond, to observe a large Dragon-fly as it was hawking backward and forward in search of prey, when suddenly, a white butterfly, *Papilio Brassicae*, flew past. The Dragon-fly instantly attacked and caught it in the air, then settled on a twig, close at hand, to eat it at leisure. It bit off the wings, and then, in less than a minute, devoured the body.

These insects, which are very common in England, delight in sunshine, and are seldom to be seen abroad in cloudy weather, hiding themselves, during the absence of the sun, under the leaves and branches of trees.

OF THE EPHEMERÆ, OR DAY-FLIES*.

The Ephemeræ differ in many respects from all

* The mouth of the Ephemera has no jaws, but is furnished with four very short thread-shaped feelers. The antennæ are

other insects. Their *larvæ* live in water for three years, the time they consume in preparing for their change, which is performed in a few moments. The larva, when ready to quit that state, rises to the surface of the water, and, instantaneously freeing itself from its skin, becomes a chrysalis. This *chrysalis* is furnished with wings: it flies to the nearest tree or wall, and, there settling, it at the same moment quits a second skin, and becomes a perfect Ephemera. In this state all the species live but a very short time, some of them scarcely half an hour; having no other business to perform than that of continuing the race. They are called the insects of a day; but few of them ever see the light of the sun; being produced after sunset, during the short nights of summer, and dying long before the dawn. All their enjoyments, therefore, seem confined entirely to their larva state.

The Ephemera are very frequent near waters, and in some places they multiply enormously. About Laz, in Carniola, a province in Germany, we are informed by Scopoli, that they are so numerous in the month of June, that they are used as manure; and if each farmer cannot obtain more than *twenty cart-loads*, the harvest is considered a bad one.

The larvæ scoop out dwellings in the banks of rivers. These consist of small tubes, made like syphons, with two holes, the one serving for an entrance, and the other as an outlet; and these are so numerous, that the banks of some rivers are observed to be full of them. When the waters decrease, they dig fresh holes lower down. The flies are produced nearly all at the same instant, and in such numbers, as even to darken the air.

The females, aided by the threads of their tails, and the flapping of their wings, support themselves on the sur-

short and thread-shaped; and above the eyes there are two or three large stemmata. The wings are erect, (the lower ones much the shortest,) and the tail is terminated by long hairs or bristles.

face of the water, and, in an almost upright position, drop their eggs in little clusters into the water. A single insect will sometimes lay seven or eight hundred eggs.

THE COMMON EPHEMERA, OR DAY-FLY*.

M. de Reaumur has described very accurately the metamorphosis of a kind of Ephemera, which, except in the time of the year when it is produced, and the duration of its fly-state, seems much to resemble the present species, and is, probably, only a variety of it.

On the nineteenth of August, 1738, he waited for some time after sunset on the bank of the Seine, to see, as he had been informed he might, millions of Ephemerae issue from the water, and rise into the air; and he was returning disappointed along with his servants, who were carrying a tub containing several lumps of earth full of holes and nymphæ, when scarcely had it been set on one of the steps of the stairs, than those who had the charge of it exclaimed, "What a multitude of Ephemerae are here!" M. de Reaumur seized one of the lights, and ran to the tub. Every part of the earth that was above the water, was covered with Ephemerae, some of which had just begun to put off their coverings, others had almost effected it, and others had entirely completed it, and were about to take wing. A storm of lightning and rain, which had been some time coming on, now drove him into the house; but, to prevent the Ephemerae from flying entirely away in his absence, he had the precaution to cover the tub with a cloth. The violence of the rain continued for about half an hour, and on its ceasing he returned to the garden. On taking off the covering, he found the number of Ephemerae

* DESCRIPTION. The tail has three filaments. The wings are brown and white.

SYNONYMS. *Ephemera vulgata*. *Linnaeus*.—L'Ephémère commune, in France.

considerably augmented, and they continued to multiply for some time, as he stood watching them. The number already transformed, from the earth that the men had conveyed from the river, would have been sufficient to have filled the tub; but this number was prodigiously augmented by the accession of strangers, which were attracted by the light from all quarters. He again spread the cloth over the tub, and the light was held above it: immediately the cloth was almost concealed by the vast multitudes which alighted upon it. But what he had seen about the tub, was nothing to what he saw, when he went again to the side of the river. "The numbers of Ephemeræ," says he, "which filled the air, can neither be expressed nor conceived. When snow falls thickest, and in the largest flakes, the air is never so completely filled with these, as that which surrounded us, was with Ephemeræ. Scarcely had I remained a few minutes in one place, when the step on which I stood, was covered in every part with their bodies, to the depth of two or three, and in some places even of more than four inches. The whole surface of the water, for at least six feet from the bank, was entirely covered with a coat of Ephemeræ; those which the current carried off, were more than replaced by those which fell continually in that place. I was several times compelled to abandon my station, by retreating to the top of the stair, not being able to sustain the shower of Ephemeræ, which, not falling so perpendicularly as an ordinary shower, or with an obliquity equally constant, struck me uninterruptedly, and, in a very troublesome manner, on all parts of the face: my eyes, nose, and mouth, were filled with them. It was an unpleasant post to hold the candle on this occasion; the man who held it, had his whole body covered with these flies in an instant; they rushed to him from all parts in such quantities, as to oppress him. The light of the candle occasioned a spectacle altogether different from any thing that can be observed in any kind of meteorological shower: it was indeed enchanting. The most un-

observing of my domestics could scarcely ever have been tired of admiring it. No astronomic sphere was ever formed so complicated as this, nor was furnished with so many circular zones in every possible direction, having the flame of the candle for their common centre. Their number appeared to be infinite, having all possible degrees of obliquity with respect to each other. Each zone was formed by an uninterrupted string of Ephemeræ, which, as if tied together, followed each other close in the same line: they seemed to form a circular ribbon of silver, deeply indented on its edges; a ribbon formed of equal triangles put end to end, so that the angles of those that followed, were supported by the base of that which preceded, the whole moving round with great quickness. Ephemeræ, whose wings only were then distinguishable, and which circulated around the light, formed this appearance. Each of these flies, after having described one or two orbits, fell to the earth, or into the water, but without having been burned by the candle." At the end of about half an hour from its commencement, the great shower began to abate, and in little more than an hour, scarcely any Ephemeræ could be seen above the river, and no more came near the candle. This phenomenon, M. de Reaumur found, upon examination, took place every evening, during most of the summer months; and usually commenced about the same hour.

In this short period of existence, the female appears to have no other business than to lay her eggs. These are contained in two large packets, each enclosing from 300 to 400. They are both extruded from the body at the same time, through two openings formed for the purpose, and they fall together in one accumulated mass, upon the water. To enable the creature to extrude these, and at the same time to fill up the great vacuum in the abdomen, that must instantaneously take place, the fly is provided with a couple of small bladders, which it has the power of filling with air.

The singular quickness and ease, with which these

little creatures strip themselves of the slough of the nymph, in order to become flies, are very surprising: We do not draw our arm more quickly from the sleeve of a coat, than the Ephemera draws its body, its wings, its legs, and the long filaments of its tail, from that complicated vestment, which forms a kind of sheath for all these parts. No sooner is a rent effected in the corselet, and the body seen through that rent, than the rest of the operation is finished in an instant. Sometimes, indeed, it happens, that the filaments of the tail cannot be so quickly disengaged as the rest of the body. In this case, the insects fly away with their slough appended: and sometimes also these slender filaments are broken off.

OF THE PHRYGANEÆ, OR CADEW FLIES*.

The Phryganæ are to be observed, during the spring and summer months, flying about, or resting upon the grass and weeds near the borders of rivers, streams, and ponds. They deposit their eggs on aquatic plants. These are enclosed in a glairy matter, as transparent as water, and of the consistence of jelly, by means of which they firmly adhere to the place where they have been deposited.

The larvæ, when hatched, form for themselves tubes of silk, the interior of which is smooth and polished, and to the exterior of which they attach fragments of different substances; thus constituting a strong defence against the attempts of their enemies. Some of the species employ, for this purpose, bits of leaves, straw, grass, or rushes; others adopt the shells of small aquatic snails; others, grains of sand; and others employ several different kinds mixed together. They contrive to make their habitations nearly in equilibrium with the

* The mouth is furnished with a horny, short, curved mandible, and four feelers. The antennæ are setaceous, and longer than the thorax. The wings are equal, and incumbent; and the lower ones are folded.

water, by adding a bit of wood when too heavy, and some heavier substance when too light.

The *larvæ* have each six scaly legs; and their body is composed of twelve annules. The legs are attached to the three first rings, and the fourth has three fleshy eminences, by which they are supposed to respire and reject water. They feed on the *larvæ* of other water-insects, and also on the leaves of aquatic plants.

THE GREAT CADEW FLY*.

The *larvæ* of the Great Cadew Flies, form a case with small bits of wood disposed longitudinally. In the interior of this they reside, and undergo their change into a *pupa* state. As in the other species, their tube is exactly cylindrical, having an opening at each end.

They are unable to swim; but can crawl nimbly about at the bottom of the water, or up the stalks and upon the leaves of aquatic plants, on which they feed. In the act of crawling they push out of the case their head and legs, dragging at the same time, like the snail, their habitation along with them.

Like the *larvæ* of other Cadew Flies, they undergo their change to the *pupa* state, under the protection of their case; closing for this purpose both the apertures. This is done with a kind of silk, which they spin from their bodies, and which forms a kind of net-work, of sufficient strength to defend them from the attacks of their foes, and yet with meshes sufficiently wide to admit the free passage of water for the respiration of the *pupa*.

After a lapse of fifteen or twenty days from the time of the larva having closed up its case, the *pupa* becomes so far perfected, as to abandon it. By means of its four

* DESCRIPTION. The wings are of a testaceous brown colour, with cinereous spots.

SYNONYMS. *Phryganea grandis*. Linn.—*La grande Frigane*. Cuvier.

anterior feet, which, like the others, are enclosed in a kind of envelope, it now crawls up the side of the bank, or up the stem of some aquatic plant to the surface of the water. Here it searches out a dry place, where it can rest for a little while in tranquillity, until, by the warmth of the atmosphere, its skin becomes perfectly dry. This then splits open, and, in a few minutes, the perfect insect issues forth, and, after its wings are hardened, flies away.

OF THE MYRMELEON, OR ANT-EATER TRIBE*.

The Myrmeleons constitute a tribe of insects, which, from their extremely singular habits, whilst in a larva state, are highly interesting.

The *larvæ* are hairy, with six feet; and have strong, exerted, and toothed jaws. They prey with savage ferocity on ants, and some of the smaller insects; and, for the purpose of ensnaring their prey, they form a kind of funnel or pit in light earth, at the bottom of which they lie buried. The manners of most of the tribe greatly resemble those of the following species.

The *chrysalis* is enclosed in a little ball of sand or earth, the particles of which are agglutinated together by a viscid matter, which the larva mixes with it previously to its change.

THE COMMON MYRMELEON, OR ANT-LION†.

The name of this insect has been obtained from the

* The antennæ of these insects are about the length of the thorax, and thickest at the tip. The mouth is armed with jaws, teeth, and six feelers. The wings are deflected; and the abdomen of the male terminates in a forceps composed of two straight filaments.

† DESCRIPTION. In its perfect state, this insect somewhat resembles in shape the dragon-fly. It is of a dark or blackish gray, with some spots on its thorax, and on the posterior bor-

circumstance of its larva subsisting principally on ants. This food it is able to obtain only by stratagem.

The usual situation, which the larva adopts for its residence, is in a dry, sandy soil, under some old wall, or other protection from the wind. Here he forms a pit of the shape of a funnel. If this is only to be small, he thrusts himself backward pretty deep, and artfully throws out, beyond the edges of the hollow, the loose sand, which has fallen in upon him, and at the bottom he then lies concealed. If it is to be of greater extent, he begins by first tracing in the surface of the sand a tolerably large circle, which is to form its base. He then gets under the sand near the edge, and proceeding backward in a spiral direction, carefully throws up beyond the circumference of the circle, all the particles that fall upon his body: this he continues to do until he arrives at the apex of the cone he has thus formed. His long neck, and flat head, he uses as a spade; and the strength of these parts is so great, that he is able to throw off at once a considerable quantity of sand to even six inches distance.

His pit being finished, he buries himself among the sand at the bottom, leaving only his horns visible. Here he patiently waits for his prey. When an ant or any other small insect happens to walk over the edges of the hollow, its steps force down some of the particles; which gives the Ant-lion notice of its presence. He immediately throws up the sand which covers his head, to overwhelm the ant, and, with its returning force, to bring it to the bottom. This he continues to do till

der of the rings of its abdomen. The wings have some spots of blackish brown.

The *larva*, in its general appearance, is not much unlike a spider. Its body is of a dirty gray colour, marked with black spots. The head is small and flat, and from this proceeds two horns, each about the sixth of an inch long, hard, hollow, and hooked at the end.

SYNONYMS. Myrmeleon formicarius. Linn.—Le Myrmé-léon des Fourmis. Tigny.

the insect is overcome, and falls between his horns. Every endeavour to escape, when once the incautious ant has stepped within the verge of the pit, is vain; for, in all its attempts to climb the side, the deceptive sand slips from under its feet, and every struggle precipitates it still lower. When within reach, the Ant-lion plunges the points of his jaws into its body, and having sucked out all its juices, throws out the empty skin to some distance. This done, the Ant-lion mounts the edges of his pit, and repairs whatever injury it may have sustained; and then, descending, again conceals himself at the bottom.

The jaws of this creature are hollow, and serve as pumps to draw into its stomach the juices of those insects on which it feeds; for in the head there is no mouth, nor any organ which can answer the same purpose. The horns being therefore so necessary to its life, nature has provided for the restoring of them in case of accident; for, if cut off, they will grow again.

The food which this creature procures by its pit, can be but little; and as it has no power of catching its prey by any other mode, its motions being very slow, some persons have believed, that its thus catching now and then an ant, was rather an act of diversion than of hunger. But though the Ant-lion will live a long time without food, and even pass through all its changes when shut up in a box, yet it is always ready to eat, when food is offered to it. It always appears starved and small when kept thus; and if a fly be given to it in that hungry state, it will suck out all its juices so perfectly, that the remaining shell may be rubbed to powder between the fingers, whilst the body of the creature that has sucked it, appears remarkably swelled and distended. For the sake of experiment, M. Poupert put an Ant-lion into a wooden box with some sand, and covered it with a glass, so as to exclude every other insect. Here it formed its cone, and watched as usual for prey, though in vain. Thus he kept it for several months; while in an adjoining box he kept another of

the same species, which he supplied with food, by giving it ants and flies. He could perceive no difference between the movements or actions of the two; but when he took them from their holes, he found the abdomen of that which had received no food, was shrunk to a very diminutive size, whilst the other retained its proper shape.

When the Ant-lion has lived its usual time in the larva state, it leaves its pit, and buries itself under the surface of the sand. Here it encloses itself in a fine web, in which it is to pass its transformation into a winged state. This web is made of a sort of silk, and of a quantity of grains of sand, cemented together by a glutinous humour which flows from its pores. This case, however, would be too harsh and coarse for the body of the creature, and therefore it serves only for the covering, to defend it from external injuries; the animal spinning one of pure and incomparably fine silk, of a beautiful pearl colour, within it, which covers its whole body.

When it has lain some time in this case, it throws off its outer skin, and becomes an oblong nymph or chrysalis, in which a careful eye may trace the form of the fly, into which it is to be transformed. This nymph makes its way about half out of the shell, and remains in this condition, but without further life or motion, until the perfect fly comes out at a slit in the back.

When this insect forms its pit in a bed of pure sand, its habitation is made and repaired with great ease; but, where it meets with other substances among the sand, the labour becomes much more embarrassing. If, for instance, when the creature has half formed the pit, it comes to a stone of moderate size, it does not on this account desert the work; but it goes on, intending to remove that impediment the last. When the pit is finished, it crawls backward up the side of the place where the stone is; and, getting its tail under it, takes great pains and time to get it on a true poise, and then begins to crawl backward with it up the edge to the

top of the pit, to get it out of the way. It is a common thing to see the Ant-lion labouring in this manner at a stone four times as big as its own body; and as it can only move backward, and the poise is difficult to be kept, especially up a slope of such crumbling matter as sand, which moulders away from under its feet, and necessarily alters the position of its body, the stone, when near the verge, frequently rolls down to the bottom. In this case the animal attacks it again in the same way, and is not discouraged by many miscarriages; but continues its struggles so long, that it at length gets it over the verge of the place. When it has done this, it does not leave it there, lest it should roll in again: but it is always at the pains of pushing it further on, till it has removed it to a necessary distance from the edge of the pit.

This insect, in a perfect state, is but seldom found; it is, however, sometimes to be met with in sandy places, and near rivulets. It is marked in Dr. Turner's Translation of the *Systema Naturæ*, as a native of this country; but I have never yet heard of any one having discovered it within our island.

Hymenopterous Insects*.

OF THE CYNIPS, OR GALL-INSECT TRIBE†.

Most of the Gall-insects are produced from eggs deposited by the parents in the tender branches, or upon

* The insects of the Linnean order *Hymenoptera* have generally four membranaceous, naked wings. In some of the tribes the neuters, and in others, the males or females, are destitute of wings. The tail, in the females and neuters, is armed with a sting.

† The mouth is furnished with a short, single-toothed,

the leaves, of trees, in the spring of the year; others live concealed among the leaves, and others are bred in the bodies of other insects.

Those which deposit their eggs in the branches or leaves of trees, place them in a small hollow, which they form by means of an instrument at the posterior part of their body. Each egg is fixed to the spot by a kind of gluey matter, with which it is covered.

The juices of the leaf or stem overflow by the small vessels, which are opened in this operation, and thus form a gall or excrescence, in which the egg becomes enclosed. When the larva is hatched, it finds around it the food, that is necessary for its subsistence. It gnaws and lives upon the substance of the gall, which increases in bulk and consistence, in proportion as its interior is thus destroyed.

Some of these galls have, in their interior, either only one cavity, in which many larvæ are enclosed together, or many small cavities, having a communication with each other; some have many separate cavities; and others have only one cavity, which is occupied by a solitary insect.

When the larvæ have attained their full growth, some of the species eat their way out, and drop upon the earth, in which they bury themselves, and there undergo their metamorphosis; and others are transformed within the galls, and leave them only as perfect insects.

THE GALL-INSECT OF THE GROUND-IVY*.

These insects sometimes deposit their eggs on the

membranaceous jaw. The mandibles are horny and cleft, and the lip is entire. The feelers are four in number. The sting is spiral, and often concealed within the body.

* DESCRIPTION. This insect is of a blackish brown colour, with the thorax somewhat downy.

SYNONYMS. *Cynips glechomatis*. Linn.—*Le Cinips du Lierre terrestre*. Tigny.

stems, but most commonly on the leaves, of the ground-ivy. The galls produced are, in general, smaller than those of the oak, though they are sometimes seen as large as a small nut. Their interior is soft and spongy; and on the exterior there are several fibres or small fleshy scales. Towards the centre the galls are hard and ligneous. Each gall contains in its centre a single larva.

THE OAK-BUD* AND OAK-LEAF GALL-INSECT†.

The eggs of the former of these insects are deposited in the buds of the oak. Here they produce a beautiful imbricated gall, in appearance not much unlike a rose-bud when beginning to blow. In the centre of this there is a ligneous kernel, which has a cavity that contains the larva. The little creature there feeds, grows, and undergoes its metamorphosis. The whole gall is sometimes nearly an inch in diameter, and it is connected to the branch by a short pedicle or foot-stalk.

On the undersides of the leaves of the oak there are frequently to be seen several small spherical galls. These are formed around the larvæ of the latter of the above-mentioned insects. They are generally fastened to the fibres of the leaf, and each contains a single insect. The cavity is large, and the gall is ligneous in the interior. Its parietes are generally about twice the thickness of an oak-leaf.

* DESCRIPTION. The length of this insect is about a line. Its body is of a golden green colour. The antennæ and legs are yellowish.

SYNONYMS. *Cynips quercus-gemmæ*. Linn.—Le Cinips rosacé. Tigny.

† See Plate xix. Fig. 6. 6*.

DESCRIPTION. The antennæ are pale yellow. The thorax and abdomen are golden green; and the legs pale.

SYNONYMS. *Cynips quercus-folii*. Linn.—Le Cinips des Feuilles. Tigny.

OF THE TENTHREDO, OR SAW-FLY TRIBE*.

By means of the saw with which these insects are supplied, some of the species deposit their eggs in the buds of flowers, and others in the twigs of trees or shrubs. This implement, which is situated in the posterior part of their body, is formidable only in appearance, and seems destined solely to the purpose of depositing their eggs.

The larvæ have from eighteen to twenty-eight legs. They subsist on the leaves of plants; and, when full grown, some of them bury themselves in the ground, and others form a nidus between the leaves of the plant on which they feed, and within it change to a *pupa*. Those which undergo their change under the earth, usually remain there during the winter, the perfect insect issuing forth in the ensuing spring.

THE SAW-FLY OF THE GOOSEBERRY-TREE†.

This species of Saw-fly breeds twice in the year. The larvæ may first be discovered, says Dr. Anderson, by the appearance of a few small holes in the leaves of the gooseberry-trees. Where two, three, or more such holes are remarked in a leaf, without any kind of discolouring, it will generally be found, on examining the

* The mouth has a horny curved mandible, toothed within. The jaw is straight and obtuse at the tip, and the lip is cylindrical and bifid. The feelers are four in number, and filiform. The wings are tumid, the lower ones shorter than the others. The sting is composed of two serrated laminae, and is almost concealed in the body.

† DESCRIPTION. This insect, says Dr. Anderson, is small, of a yellowish tinge, and, in its general appearance, is not much unlike a common house-fly. *Anderson's Recreations in Agriculture.*

SYNONYM. *Tenthredo grossulariæ.*

under part, that a few of the caterpillars only have been hatched, and have each begun to eat. But the creatures are now so small, and so much of the same colour as the leaf, that this must be examined with considerable attention, before they can be perceived. The greatest part of the brood continue still in the eggs, which may be found adhering to the larger ribs of the leaf in regular rows, of an oblong shape, and appearing like little white specks.

From this regular disposition of the eggs upon the leaf, it is evident, that they must have been deposited there by the parent fly, after the leaf has been formed. Not long after the eggs are hatched, the little animals eat so voraciously, that their holes will be found run one into another, and the whole soft part of the leaf eaten out, leaving only the fibres untouched. As many as a hundred and fifty of these caterpillars have been counted on a single leaf, the half of which, if suffered to go on undisturbed until their full growth, would alone devour all the leaves of a large bush. So that by plucking off this single leaf at a proper time, not only those of the whole bush may be saved, but, at the same time, the future ravages of such as would spring from them, would be prevented.

When the insects are about to enter their chrysalid state, they conceal themselves in the earth. Here they undergo their change, and after a short time become perfected. This usually takes place about the month of July. These insects now deposit their eggs, and die.

At this season of the year the eggs are very soon hatched, and in the autumn, the young caterpillars issue forth in swarms, and destroy the leaves. Many of them perish from the leaves falling before they arrive at maturity. Such, however, as enter the chrysalid state previously to this defect of food, pass the winter in this state, and are changed into flies early in the spring.

The flies are of a sluggish disposition, often remaining stationary on the leaves for several minutes, and

not being easily disturbed. This sluggishness renders them an easy prey to birds, by which they are eagerly devoured.

OF THE ICHNEUMONS IN GENERAL*.

The larvæ of all the Ichneumons derive nutriment from other insects. The female, when about to lay her eggs, perforates with her sting either the body or the nidus of some other insect or caterpillar, and deposits them there. The sting of one of the species, though extremely fine, is so strong as to penetrate through mortar and plaster. The food of the family to be produced from the eggs of this fly, is the larvæ of wasps or mason-bees; for the parent Ichneumon no sooner discovers one of the nests of these insects, than it fixes on it, and in a moment bores through the mortar, of which it is built.

Some species agglutinate their eggs upon caterpillars; others penetrate the bodies of caterpillars, and deposit their eggs in the inside. When the *larvæ* are hatched, their heads are so situated that they pierce the caterpillars, and penetrate to their very entrails. These larvæ suck the nutritious juices of the creatures without attacking their vitals; for they seem to be all the time perfectly healthy, and even sometimes are enabled to transform themselves into chrysalids. "A friend of mine," says Dr. Derham, "put about forty large caterpillars, collected from cabbages, on some bran and a few leaves, into a box, and covered it with gauze to prevent their escape. After a few days we saw, from more than three-fourths of them, about eight or ten

* The antennæ of the Ichneumon-flies taper towards their extremity, and consist of more than thirty joints or articulations. The mouth is armed with jaws, and has four unequal, thread-shaped feelers. At the extremity of the abdomen there is a long sting, having, however, no pungent property, enclosed in a cylindrical sheath composed of two valves.

little caterpillars of the Ichneumon fly come out of their backs, and spin each a small cocoon of silk, and in a few days the large caterpillars died." The Ichneumons performed singular service, in the years 1731 and 1732, by multiplying in the same proportion as the caterpillars. Their larvæ consequently destroyed infinitely more of these voracious creatures, than could possibly have been done by all the efforts of human industry. Aphides, or Plant-lice, and the larvæ of various other insects, are also made the nidus of the Ichneumon.

ICHNEUMON MANIFESTATOR*.

The care and attention paid by the whole of the animal creation to the preservation of their offspring, is a subject that has employed the attention and excited the admiration of all ages; yet there are few creatures in which these properties are more manifest, than in this diminutive animal.

Thomas Marsham, Esq. an accurate observer of nature, seems to have been the first who has recorded this part of the economy of the Ichneumon Manifestator. In the month of June, 1787, he observed one of these insects on the top of a post in Kensington Gardens. It moved rapidly along, having its antennæ bent in the form of an arch. With a strong vibratory motion in them, it felt about until it came to a hole made by some insect, and into this it thrust them quite to the head. It remained about a minute in this situation,

* **DESCRIPTION.** The present species is about an inch in length, from the head to the extremity of the abdomen: the tail measures nearly an inch and a half, and the antennæ are somewhat more than half an inch long. The body is black, and the legs are dusky. The abdomen is cylindrical and sessile, not being connected with the thorax, as in several of the species, by a pedicle.

SYNONYMS. Ichneumon Manifestator. Linn. Gmel.—
L'Ichneumon Manifestateur. Tigny.

apparently very busy; then drawing its antennæ out, it came round to the opposite side of the hole, and again thrust them in, and remained nearly the same time. It next proceeded to one side of the hole, and repeated the same operation there. Having now again drawn out its antennæ, it turned about; and, dexterously measuring a proper distance, threw back its abdomen over its head and thorax, and projected the long and delicate tube at its tail into the hole. After remaining nearly two minutes in this position, it drew out the tube, turned round, and again applied its antennæ to the hole for nearly the same time as before; and then again inserted its tube. This operation was repeated three times; but Mr. Marsham approaching too near, in order, if possible, to observe with a glass what was passing in the tube, he frightened the insect entirely away.

About a week afterwards, Mr. M. was in Kensington Gardens, and saw several of these Ichneumons at work. They seemed to pierce the solid wood with their tubes, which they forced in even to half their length, constantly passing them between the hinder thighs, which they closed in order to keep the tubes straight, when over-resistance would otherwise have forced them to bend. It appeared truly surprising to see an instrument, apparently weak and slender, able, with the strength of so small an animal, to pierce solid wood half or three quarters of an inch deep; but, on particular attention, it was discovered, that all those which seemed to pierce the solid wood, did it through the centre of a small white speck, resembling mould or mildew. The latter, on minute examination, was found to be fine white sand, delicately closing up a hole made by the *Apis maxillosa*, and where, no doubt, young bees were deposited.

In deep holes that were not closed, the insect not only thrust in the whole tube, but, in some cases, the whole of its abdomen and posterior legs, leaving out only the two fore feet and wings, which it placed in

contrary directions like arms. The two cases of the tube were also projected up the back, with the ends appearing above the head out of the hole.

From Mr. Marsham's account, it appears that these insects do not adopt any hole indiscriminately as a situation for their eggs; for, in many instances, he saw them thrust their antennæ into holes and crevices, from which they almost immediately withdrew them. As the whole of the Ichneumons deposit their eggs in the body of some other creature as a nidus, it appears probable, that in these instances the insects found the holes empty, and that they proceeded in search of those, in which the young-ones of the *Apis maxillosa* were deposited.

A particular instance of sagacity in one of these little animals, is deserving of remark. While it had its tube inserted, the cases were, as usual, projected upwards out of the hole; and the wind, being very powerful, rendered it difficult for so delicate a creature to maintain its position, as these long cases were so strongly acted upon by the wind, as to endanger its being upset several times. To remedy this inconvenience, it brought the cases, with wonderful dexterity, between its legs, and projected them forward under its body toward the head; by which means it securely retained its position.

OF THE SPHEGES IN GENERAL*.

Many species of Sphex are common in England. They are chiefly found in woods and hedges; and their larvæ feed on dead insects, in the bodies of which the parent Spheges lay their eggs.

* The antennæ in this tribe consist of ten joints or articulations; and the mouth is armed with jaws. The wings in both sexes are extended, and do not fold together. The sting is pungent, and concealed within the abdomen.

Some of the species, like dogs, dig holes in the earth, with their fore feet, and in each of these, after having deposited their eggs in its body, they bury an insect, and then carefully close it up with earth.

There are no insects, which display greater affection for their offspring than these; nor are any more rapacious. They are excessively fierce, and, without hesitation, attack insects much larger than themselves. Their strength is very great; their jaws are hard and sharp, and their stings are armed with poison, which suddenly proves fatal to most of the creatures with which they engage. The *Sphex* seizes, with the greatest boldness, on the creature it attacks, giving a stroke with amazing force, then falling off, to rest from the fatigue of the exertion, and to enjoy the victory. It keeps, however, a steady eye on the object it has struck, until it dies, and then drags it to its nest for the use of its young. The number of insects, which this creature destroys, is almost beyond conception, fifty scarcely serving it for a meal. The mangled remains of its prey, scattered round the mouth of its retreat, sufficiently betray the sanguinary inhabitant. The eyes, the filament that serves as a brain, and a small part of the contents of the body, are all that the *Sphex* devours.

THE TURNER SAVAGE*.

This insect lives in the haunts of men, whom it never willingly offends; but it is the terror of all the smaller insects. It inhabits holes in the earth on the sides of hills and cliffs, and recesses that it forms for itself in the mud walls of cottages and outhouses. The mud-wall of a cottage at Peterborough, in North-

* DESCRIPTION. The body is black, and the legs and the petiole which connects the abdomen and thorax, are yellow.

SYNONYMS. *Sphex spirifex*. Linn.—Le *Sphex* porte-épine, in France.

amptonshire, was observed to be frequented by these creatures; and, on examination, it was found to have been wrought by their operations, into the appearance of honey-comb.

The eggs, as in all the other species, are deposited by the female in the back part of the cells. These cells are stored with insects, for food to the larvæ as soon as they come into life, and are then filled up.

Dr. Derham observes, that a species of Savage built its nest in a little hole of his study window. The cell was coated with an odoriferous and resinous gum, collected, as he supposed, from some neighbouring fir-trees. The insect laid two eggs, and the Doctor soon afterwards observed it several times to carry in maggots, some of which were even larger than itself. These it sealed up with great carefulness in the nest, and then altogether left it.

OF THE SAND-WASP TRIBE*.

The Sand-wasps were separated, by the Rev. Mr. Kirby, from the last tribe, though, in their manners and economy, the insects of each have a near resemblance. In their external appearance, however, there are characteristics sufficient to admit, with great propriety, of two genera.

THE COMMON SAND-WASP†.

About sandy banks, exposed to the sun, this insect is very common in many parts of England. It is

* The beak is conical, inflected, and contains a retractile, tubular tongue, that is cleft at the end. The jaws form a kind of forceps, and are three-toothed at the tip; and the antennæ in each sex are thread-shaped, with about fourteen joints or articulations. The eyes are oval, and the wings plane. The sting is pungent, and concealed in the abdomen.

† **DESCRIPTION.** In this species the antennæ have thirteen articulations, and are inserted in a hollow on the front of

easily distinguished from other insects by the elongated pedicle of its abdomen, and its very short wings. When it flies, it always carries its abdomen pointing upward, so as to be nearly at right angles with that part of the thorax, to which it is attached.

In its manners, this Sand-wasp is nearly allied to the species of the preceding genus. The most pleasing fact I have seen respecting it, is that related by Mr. Ray: "I observed one of these insects (says he) dragging a green caterpillar, thrice its own size. It laid this down near the mouth of a burrow, that it had made in the ground; then, removing a little ball of earth, with which it had covered the orifice, it first went down itself, and, after having staid a short time, returned, and seizing the caterpillar again, drew it down also. Leaving the caterpillar there, it came up again, and taking some little globules of earth, rolled them one by one into the burrow, scraping the dust in at intervals with its fore feet, in the manner of a dog; thus alternately rolling in pieces of earth, and scraping in dust, till the hole was full; sometimes going down (as it seemed) in order to press down the earth; and once or twice flying to a fir-tree which drew near, perhaps for the purpose of getting turpentine to glue it down, and make it firm. The hole being filled, and equalled with the superficies of the earth, that its entrance might not be discovered, the insect took two fir-leaves that were near, and laid them by the mouth, most probably to mark the place."

THE BLUE SAND-WASP*.

These little creatures form for their cells cylindrical

the head. The abdomen is club-shaped, and joined to the thorax by a long two-jointed pedicle. The wings are equal, and the colours of the body are black and ferruginous alternately.

SYNONYMS. *Sphex sabulosa*. Linn.—*Ammophila vulgaris*. Kirby, in Linn. Tran.—*Le Sphex du Sable*, in France.

* DESCRIPTION. This insect is about three quarters of an

tubes of clay, (each about the thickness and length of the little finger) against the timber under the roofs of houses, or under pales, where they are sheltered from the weather. Eight or ten of these are arranged by the side of, and joining to each other. Each of these tubes is divided by several partitions, betwixt every one of which the female lays an egg, and deposits the bodies of several insects, for the support of the future young-one. When one tube is stopped up, another is begun at its end; and so on, till the whole work is completed. These insects are silent at all times, except during the plastering and forming of their cells; but they no sooner set about their work, than they emit a singular, but pleasing sound, which is audible at the distance of ten or twelve yards, and seems to render their labour cheerful to them. It is exceedingly diverting to observe the dexterity and the whimsical gesticulations, which they adopt in performing this important business. They first moisten the clay, then temper it into a little lump of the size and shape of a swan-shot, and apply it to the walls of their nest. They commence their operation at the upper part, and work downward, till the cell is long enough to contain the chrysalis. After having spread out this little lump in a proper manner, they return for fresh materials. They cease their humming noise the moment they depart from their cell, but they always commence it immediately on putting together the materials which they have collected. When a cell is finished, they are always careful to render it perfectly smooth on the inside.

The insects which this fly secures for its young ones,

inch long, and of a dark blue colour. The pedicle connecting the abdomen and thorax, is about a quarter of an inch in length. The antennæ are black, and the wings are tinted with blue, and tipped with black.

It is found in Carolina, and various other parts of North America.

SYNONYMS. *Sphex cyanea*. *Linnaeus*.—*Vespa Ichneumon cærulea*. *Catesby*.—*Ammophila cyanea*. *Kirby*.

are principally spiders. This will in some measure account for its generally forming its cell under roofs of buildings, and in other places where spiders are usually found. It does not kill them, but only in some manner so disables them that they cannot escape; by which means they are preserved alive and uncorrupted, until the young larva is produced, which is not long after the egg is deposited. They sometimes seize and fly off with spiders that are equal in size to themselves; and when one of them proves too weighty to be thus carried off, if it be not at a great distance, the insect drags it to her nest. Mr. Catesby once saw a spider dragged up a wall by one of these flies to its nest; and both of them being caught and weighed, it was found that the spider was eight times the weight of the fly.

By the time the larva has devoured all its provision, it is ready to undergo its change; and for this purpose it spins for itself a fine silken case, about the end of September. It remains in a chrysalid state until the spring; when it gnaws its way out of the clayey dwelling, and becomes an inhabitant of the air.

THE PENNSYLVANIAN SAND-WASP*.

The nest of this species, as well as that of the last, is formed with considerable art and ingenuity. The insect scratches in the steep side of some bank of loamy earth, a horizontal hole, about an inch in diameter, and nearly a foot long, making it smooth within, and pressing down the earth so strongly as to secure it from

* DESCRIPTION. This sand-wasp is about an inch long, and of a black colour, with the wings inclining to violet. It is an inhabitant of North America, where it feeds on grasshoppers and other insects, as well as on various kinds of fruit.

SYNONYMS. *Sphex Pennsylvanica*. Linn. ?—*Ammophila Pennsylvanica*. Kirby.—Great Black Wasp from Pennsylvania. Bartram.

giving way. She then flies off and seizes one of the large green grasshoppers, and lodges it safely at the further end. After laying an egg, she again goes off and catches two others, which she deposits with the former, and then closes up the hole. The larva, when produced, feeds on the bodies of the grasshoppers until it changes into a chrysalis. It remains in a chrysalid state for some time; and when it becomes perfected, it eats its way out and flies off.

The grasshoppers caught for the caterpillars of the Pennsylvanian Sand-wasp are often much larger and more strong than the parent insect, so that considerable care is necessary in attacking them. She is said to seize them suddenly, and to plunge her sting into their body in such a manner as not to kill, but merely to render them inactive; for, as in the last species, it is necessary that they should be kept alive for some time in the nest, or they would otherwise putrify, and become unfit for the purpose they were designed to answer.

OF THE WASP TRIBE*.

The Wasps, like Bees, are in general found in large societies; and they construct curious combs or nests, in which they deposit their eggs. Some, however, are solitary, and form for each young-one a separate nest. Their *larvæ* are soft, without feet, and are fed with the nectar of flowers or honey, but of a kind very inferior to that collected by the bees. The *chrysalis* is without motion, and has the rudiments of wings.

A distinguishing character of this tribe is their having smooth bodies, apparently without hairs, and their upper wings, when at rest, folded through their whole length. At the base of each of these there is a scaly

* The mouth is horny, and furnished with a compressive jaw, and four unequal, thread-shaped feelers. The antennæ are filiform, the first joint longer than the rest, and cylindrical. The sting is pungent, and concealed within the abdomen.

process, that performs the office of a spring, in preventing the wings from rising too high; a caution of some importance to these carnivorous insects, which pursue their prey at full stretch of wing.

THE HORNET*.

It is chiefly in the hollow trunks of decayed trees that the Hornets form their nest. They live collected together in communities, which consist of males, females, and neuters or labourers. Their nest is of a dirty yellowish colour, and usually constructed under the shelter of some outhouse, in the hole of an old wall, or more frequently in the hollow trunk of some decayed tree. The hole of entrance to this nest is often not more than an inch in diameter.

In the spring of the year, those of the females which have survived the winter, are reanimated by the warmth of the season, issue from their hiding-places, and search out a convenient place in which they can establish their nest. When this is found, they commence their first operation by forming a column, of the same materials as those which are afterwards employed in the other parts of the fabric, but much more compact and solid. This column the female fixes in the most elevated part of the vault, which is intended to contain the nest. A kind of cover is next formed, and then a small comb of hexagonal cells, with their openings downward, for the purpose of containing her eggs and the grubs which issue from them.

The eggs are soon hatched, and the mother nourishes her offspring with food which she brings to them from abroad. When the grubs have attained their full size, they each spin a silken bed, in which they undergo

* DESCRIPTION. This is an insect of large size. The thorax is black, the fore-part rufous. The extremity of the abdomen is yellow, with three black points on each segment.

SYNONYMS. *Vespa crabro*. Linn.—*Le Frélon*. Cuvier.

their metamorphoses into *pupæ*, and afterwards into perfect or winged insects.

The insects first produced are the neuters. These are the working insects, or labourers. From their first entrance into life they are occupied in the work of constructing cells, and in the duty of nourishing the remaining grubs.

As the females still continue to lay their eggs, the family is consequently augmented; and the nest becoming at length too small, necessity requires it to be enlarged. This operation also falls upon the labourers.

In the month of September and the beginning of October, the brood of males and females quit their *pupæ* state. All that are left, whether males, females, or neuters, are generally put to death before the end of October, particularly if the frosts have at all begun to be felt. The Hornets, in place of continuing to nourish the remaining grubs, are now occupied only in tearing in pieces the cells, and throwing them out of the nest. After this period both the males and the neuters daily perish in great numbers; so that, by the end of winter, the females, which are enabled to pass that season in a torpid state, are the only ones that remain alive.

Thus terminates this society, of which the greatest population does not often exceed the number of a hundred or a hundred and fifty individuals.

The combs are composed of a substance which somewhat resembles coarse paper or old parchment.

These insects are extremely voracious. They seize upon, and devour, with great eagerness, other insects, and frequently even bees. Their size gives them a superiority over almost all the flies which they attack; but as they are somewhat slow and heavy in their flight, these are frequently able, by their greater agility, to escape,

THE COMMON WASP*.

The nest of the common Wasp is always formed under the surface of the earth, and these insects not unfrequently occupy with it the forsaken dwelling of a mole. The entrance to the nest is a passage usually about an inch in diameter, from half a foot to two feet deep, and generally in a zigzag direction.

When exposed to the view, the whole nest appears to be of a roundish form, and is twelve or fourteen inches in diameter. It is strongly fortified all round with walls, in layers, formed of a substance somewhat like paper, the surface of which is rough and irregular. In these walls, or rather in this external covering, two holes are left for passages to the combs, one of which is uniformly adopted for entrance, and the other as a passage out. The interior of the nest consists of several stories, or floors of combs, which are parallel to each other, and nearly in an horizontal position. Every story is composed of a numerous assemblage of hexagonal cells. These contain neither wax nor honey, but are solely destined for containing the eggs, the worms which are hatched from them, the chrysalids, and the young Wasps until they are able to fly. The combs are from eleven to fifteen in number. Reaumur computed the number of cells in the combs of a middle-sized nest to be at least ten thousand; and as every cell serves for three generations, a nest of this description would annually give birth to *thirty thousand* Wasps.

The different stories of combs are always about half an inch distant. By this arrangement, free passages are left to the Wasps from one part of the nest to another. Each of the larger combs is supported by about

* See Plate xix. Fig. 7.

SYNONYMS. *Vespa vulgaris*. Linn.—La Guêpe commune, in France.

fifty pillars, which at the same time that they give solidity to the fabric, greatly ornament the whole nest. The lesser combs are supported by a similar contrivance. The Wasps always begin at the top and work downward.

M. de Reaumur, in order to examine some parts of the internal economy of these insects, contrived to make them lodge and work in glass hives, like the honey-bees. Their extreme affection for their offspring aided him greatly in this: for he found that, although their nests were cut in various directions, and even exposed to the light, they never deserted them, nor relaxed in their attentions to them.

Immediately after a Wasp's nest had been transported from its natural situation, and covered with a glass hive, the first operation of the insects was to repair the injuries it had suffered. With wonderful activity they carried off all the earth and foreign bodies that had accidentally been conveyed into the hive. Some of them occupied themselves in fixing the nest to the top and sides of the hive, by pillars of paper, similar to those that support the different stories or strata of combs; others repaired the breaches it had sustained; and others fortified it, by augmenting the thickness of its external cover.

In the formation of their nests, Wasps differ greatly from the bees. Instead of collecting the farina of flowers, and digesting it into wax, they gnaw small fibres of wood from the sashes of windows, the posts and doors of gardens, or old rails, which their strong and serrated jaws enable them to do with great ease. These fibres, though very slender, are often a tenth of an inch in length. After cutting a certain number, they collect them into small bundles, transport them to their nest; and, by means of a glutinous substance furnished from their own bodies, the labouring Wasps, which are employed in the nests, form them into a moist and ductile paste. Of this substance they construct the external cover, the partitions of the nest, the hexagonal

cells, and the solid columns that support the several stories of the comb.

In the republic of Wasps, like that of Bees, there are three different kinds of flies; males, females, and neuters. The greatest share of labour devolves upon the neuters: but they are not, like the neuter bees, the only workers; for there is no part of the different operations which the females, at certain times, do not execute. Nor do the males remain entirely idle. The neuters, however, build the nest, feed the males, the females, and even the young-ones. But, while these are occupied in different employments at home, the others are abroad in hunting-parties. Some of them attack with intrepidity live insects, which they sometimes carry entire to the nest; but if these be at all large, they transport only the abdomen. Others make war on the bees, killing them for the honey they have in their bodies, or plundering their hives for the fruits of their labour. Some resort to the gardens, and suck the juices of fruit; and others pillage butchers' stalls, from which they often arrive with a piece of meat larger than even half of their own bodies.

When they return to their nest, they distribute a portion of their plunder to the females, to the males, and to such neuters as have been usefully occupied at home. As soon as a neuter enters the nest, it is surrounded by several Wasps, to each of which it freely gives a portion of the food it has brought. Those that have not been hunting for prey, but have been sucking the juices of fruits, though they seem to return empty, fail not to regale their companions; for, after their arrival, they station themselves at the upper part of the nest, and discharge from their mouths two or three drops of clear liquid, which are immediately swallowed by the domestics.

The neuter Wasps are the smallest, the females are much larger and heavier than these, and the males are of an intermediate size between the two. In the hive of the Honey-bee, the number of females is extremely

small; but in a Wasp's nest they often amount to more than three hundred.

The eggs are white, transparent, and of an oblong shape; but they differ in size, according to the kind of Wasps that are to proceed from them. At the end of eight days after they are deposited in the cells, the grubs are hatched. These demand the principal care of such Wasps as continue always in the nest. They are fed in the same manner as birds, by receiving, from time to time, a mouthful of food from the insects which have the care of them. It is astonishing to see with what industry and rapidity a female runs along the cells of a comb, and distributes to each worm a portion of nutriment. In proportion to the ages and conditions of the worms, they are fed with liquid substance, or with solid food.

When a worm is so large as to occupy its whole cell, it is ready to be metamorphosed into a chrysalis. It then refuses all nourishment, and ceases to have any connexion with the Wasps in the nest. It closes the mouth of its cell with a fine silken cover. This operation is completed in three or four hours, and the animal remains a chrysalis nine or ten days. After this, it destroys, with its teeth, the external cover of the cell, and issues forth a winged insect, which is either male, female, or neuter, according to the nature of the egg from which it was hatched. In a short time the Wasps newly transformed receive the food that is brought to them by the foragers from the fields. What is still more wonderful is, that in the course of even the first day after their transformation, the young Wasps have been observed to go into the fields, bring in provisions, and distribute them to the worms in the cells. A cell is no sooner abandoned by a young Wasp, than it is cleaned, trimmed, repaired by the old ones, and rendered in every respect proper for the reception of another egg.

are constructed of different dimensions for the males, and females; and it is very remarkable,

that those of the neuters are never intermixed with the cells destined for others.

This wonderful edifice, which requires the labour of the animals for several months, serves them only for a year; and, notwithstanding its population during the summer, it is almost deserted in winter, and is abandoned entirely in the spring; for in this last season not a single Wasp is to be found in a nest of the preceding year. It is worthy of remark, that the first combs of a nest are always accommodated for the reception of the neuter or working Wasps, whose care and attention are first required; so that it uniformly happens, that before the males and females are capable of taking flight, every Wasp's nest is peopled with several thousands of neuters or workers. But the neuters which are first produced, are likewise the first that perish; for not one of them survives the termination even of a mild winter.

The female Wasps are stronger, and support the rigours of winter better than either the males or neuters. Before the end of winter, however, several hundred females die, and not above ten or a dozen in each nest survive that season. These few females are destined for the continuation of the species. Each of them becomes the founder of a new republic. With regard to the male Wasps, it is uncertain whether any of them survive. But, though not so indolent as the males of the honey-bee, they can be but of little assistance to the female; for they never engage in any work of importance, such as constructing cells, or fortifying the external cover of the nest. They are not produced till near the end of August; and their sole occupation seems to be that of keeping the nest clean: they carry out every kind of filth, and the bodies of such of their companions as happen to die. In performing this operation, two of them often join; and, when the load is too heavy, they cut off the head, and transport the dead animal at twice.

About the beginning of October, every nest presents

a strange scene of cruelty. At this season, the Wasps not only cease to bring nourishment to their young-ones, but they drag the grubs from their cells, and carry them out of the nest, where they are either killed by the Wasps, or perish from exposure to the weather and deprivation of food. This procedure would at first seem a strange violation of parental affection; but the intentions of Providence, though they often elude our researches, are never wrong. What appears to us cruel and unnatural, in this instinctive devastation committed annually by the Wasps, is perhaps an act of the greatest mercy that could have taken place. Wasps are not, like the honey-bees, endowed with the instinct of laying up a store of provisions for winter. If not prematurely destroyed by their parents, the young-ones must necessarily die a cruel and lingering death, occasioned by hunger. Hence this seemingly harsh conduct in the economy of Wasps, instead of affording an exception to the universal benevolence and wisdom of nature, is, in reality, a most merciful effort of instinct.

Like the male honey-bees, the male Wasps are destitute of stings; but the females and neuters have stings, the poisonous liquor of which, when introduced into any part of the human body, excites inflammation, and creates a considerable degree of pain. Their sting consists of a hollow and very sharp-pointed tube, having at its root a bag of pungent juice, which, in the act of stinging, is pressed out, and conveyed through the tube into the flesh. There are also two small, sharp, and bearded spears, lying, as in a sheath, within the tube. Dr. Derham counted, on the side of each spear, eight beards, which, he says, were formed somewhat like the beards of fish-hooks. These spears lie one with its points a little before the other in the sheath, to be ready, in all probability, to be first darted into the flesh; where, being once fixed, by means of its foremost beard, the other then strikes in also; and, in this manner, they alternately pierce deeper and deeper, their beards tak-

ing more and more hold in the flesh; after which the sting or sheath follows, in order to convey the poison into the wound. The hole in the tube is not exactly at the end, for in that case the instrument would not be so well able to wound: the sting is drawn to a hard and sharp point, and the incision through which the spears and poison are ejected, is a little below it. By means of this mechanism it is, that the sting, even when parted from the body, is able to pierce and make us smart; and by means of the beards being lodged deep in the flesh, it is, also, that these insects leave their stings behind them, when they are disturbed before they have had time to withdraw their spears completely into the tube.

THE CAMPANULAR WASP*.

In the summer of 1807, I found a nest of one of these Wasps, suspended to the rafter of a small bathing-house, belonging to a gentleman in the parish of Christchurch, Hants. It was of a somewhat globular shape, and in size about twice as large as a walnut.

The nidification of this insect is scarcely less curious than that of a bird. The nest is usually suspended from the upper part of some barn or outhouse, and consists of three or four, and sometimes more, concentric globes, of a consistence somewhat resembling whity-brown paper, with a small circular opening at the bottom. In the middle of the interior or central globe, is placed a congeries of cells, to the number of twelve, fifteen, or twenty. These are arranged round a kind of central column, and are composed of the same paper-like substance as the other parts; the exterior

* DESCRIPTION. This insect has a yellowish line on each side of the thorax, two yellowish spots on the scutellum, and a yellowish abdomen, with transverse black rings, accompanied by black spots at their ends.

SYNONYMS. *Vespa campanaria*. Shaw.—*Vespa Holsatica*. Latreille.—*La Guêpe de Holsteine*. Latreille.

circle of cells being somewhat lower or shorter than the rest. These curious nests are usually found from about the middle of June, to the beginning of October.

OF THE BEES IN GENERAL*.

These insects are very numerous, and differ considerably in their habits. Some of the species are found in extensive communities, which construct, with the utmost art, cells for their offspring, and repositories for their food; while others both dwell and work in solitude. The whole tribe live on the nectar of flowers, and on ripe fruit.

Their *larvæ* are soft and without feet, and the *chrysalis* resembles the perfect insect.

THE POPPY BEE†.

The Poppy Bee forms her nest in the ground, burrowing to the depth of about three inches. At the bot-

* The Bees, according to the generic character given of them by Linnæus, have a horny mouth, with the jaws and the lip membranaceous at the end: the tongue is inflected; and they have four unequal, thread-shaped feelers. Their antennæ are short and filiform, but those of the female are somewhat club-shaped. The wings are flat; and the females and neuters have pungent stings concealed in the abdomen.

The English Bees have undergone an accurate investigation by the Rev. Mr. Kirby, who has discovered no fewer than *two hundred and twenty-one* species, though fifteen years before that time none of our books mentioned so many as a dozen. He divides the Linnean genus *Apis*, into *Melitta* and *Apis*, distinguishing them by their tongues: the insects of the former having short, flattish, uninflected tongues; and those of the latter long, cylindrical, and inflected tongues, easily examined by raising them with a pin from the sheath in which they are concealed.

* DESCRIPTION. This is a little black Bee, about the third of an inch in length. Its head and trunk are thickly covered with hairs of a dirty gray colour; and the upper parts of its body are clad with grayish hairs. The abdomen is somewhat

tom she makes a large and somewhat hemispherical cavity, which, after being rendered perfectly smooth on all sides, she carefully lines with a splendid tapestry, selected from the flowers of the wild poppy. From these, with great dexterity, she cuts pieces of proper size and form, which she conveys to her cell; and, beginning at the bottom, covers with it the whole interior of this habitation of her future progeny. If the piece she has cut out and transported, be found too large for the place she intends it to fit, she clips off the superfluous parts, and conveys the shreds out of the apartment. The covering is even sometimes extended a little way round the orifice. The bottom is rendered warm by three or four coats, and the sides have never less than two. When the little animal has completed her apartment, she fills it with paste, made of pollen and honey, to the height of about half an inch; and, after having deposited an egg, she pushes down the poppy-lining until it completely covers the cell, and then closes up its mouth with earth, so nicely, as to render it not distinguishable from the adjoining soil.

THE LEAF-CUTTING BEE*.

These Bees construct cylindrical nests of the leaves of the rose and other trees. These nests are sometimes of the depth of six inches, and generally consist of six or seven cells, each shaped like a thimble. They are formed with the convex end of one fitting into the open

conical, black, and shining; but its segments are fringed with white hairs. The male is nearly of the same length as the female, but rather narrower, and somewhat more hairy. Its abdomen is inflexed, and not so hairy underneath as above. The last segment terminates in a fork with blunt teeth, and has on each side of its base a sharp spine or point.

SYNONYMS. *Apis Papaveris*. Kirby, i. 142, 214.—Abeille tapissière. Reaumur.—Mégachile du Pavot. Latreille.

* DESCRIPTION. The general colour of this Bee is brown.

end of another. The portions of leaf of which they are made are not glued together, nor are they any otherwise fastened, than in the nicety of their adjustment to each other; and yet they do not admit the liquid honey to drain through them. The interior surface of each cell consists of three pieces of leaf, of equal size; narrow at one end, but gradually widening to the other, where the width equals half the length. One side of each of these pieces, is the serrated margin of the leaf. In forming the cell, the pieces of leaf are made to lap one over the other, (the serrated side always outermost,) till a tube is thus formed, coated with three, four, or more layers. In coating these tubes, the provident little animal is careful to lay the middle of each piece of leaf over the margins of others, so as, by this means, both to cover and strengthen the junctions. At the closed or narrow end of the cell, the leaves are bent down so as to form a convex termination. When a cell is formed, the next care of the Bee is to fill it with honey and pollen, which, being collected chiefly from the thistles, form a rose-coloured paste. With these the cell is filled to within about half a line of its orifice; and the female then deposits in it an egg, and closes it with three perfectly circular pieces of leaf, which coincide so exactly with the walls of the cylindrical cell, as to be retained in their situation without any gluten. After this covering is fitted in, there still remains a hollow, which receives the convex end of the succeeding cell. In this manner the patient and indefatigable animal proceeds, till her whole cylinder of six or seven cells is completed. This is generally formed under the surface of the ground, in a fistular passage, which it entirely fills, except at the entrance. If the labour of these insects be

The segments of the abdomen are bordered with white at the sides; and the under part of its extremity is red.

SYNONYMS. *Apis centuncularia*. *Linn.*—*L'Abeille coupeuse de Rosier*. *Cuvier*.—*Mégachile centunculaire*. *Latreille*.

interrupted, or the edifice be deranged, they exhibit astonishing perseverance in setting it again to rights.

Their mode of cutting pieces out of the leaves for their work, deserves particular notice. When one of these Bees selects a rose-bush with this view, she flies round or hovers over it for some seconds, as if examining for the leaves best suited to her purpose. When she has chosen one, she alights upon it, sometimes on the upper, and sometimes on the under surface, or not unfrequently on its edge, so that the margin passes between her legs. Her first attack, which is generally made the moment she alights, is usually near the foot-stalk, with her head turned towards the point. As soon as she begins to cut, she is wholly intent on her labour; nor does she cease till her work is completed. The operation is performed by means of her jaws, with as much expedition as we could exert with a pair of scissors. As she proceeds, she holds the margin of the detached part between her legs in such a manner, that the section keeps giving way to her, and does not interrupt her progress. She makes her incision in a curved line, approaching the midrib of the leaf at first; but when she has reached a certain point, she recedes from this towards the margin, still cutting in a curve. When she has nearly detached from the leaf the portion she has been employed upon, she balances her little wings for flight, lest its weight should carry her to the ground; and the very moment it parts, she flies off in triumph, carrying it in a bent position between her legs, and perpendicularly to her body.

The larvæ of the Leaf-cutting Bees do not differ in appearance from those of the Hive-bees. When arrived at their full size, they spin a cocoon of silk, thick and solid, which they attach to the sides of their cell. Those produced first, are from the first-laid eggs; so that, when they are ready to emerge into the air, they do not interrupt each other's progress in passing through the bottom of their cells. These larvæ are exposed to

the attacks of other insects, that make their way into the cells, and deposit there their eggs.

This mode of forming a nest is not confined to the present species: several other bees perform similar operations; but they adopt the leaves of different trees for this purpose, such as those of the horse-chesnut, the elm, &c.

THE GARDEN BEE*.

This singular little insect is very common about gardens in or near towns. It forms its nest in hollow places in trees, &c. applying to this work the down of the garden campion†, and some other woolly plants. The Rev. Mr. White of Selborne, seems to have been the first naturalist who discovered it. He says, "it is very pleasant to see with what address this insect strips off the down from the campion, running from the top to the bottom of a branch, and shaving it bare, with all the dexterity of a hoop-shaver. When it has got a vast bundle, almost as large as itself, it flies away, holding it secure between its chin and fore-legs."

Sir Thomas Cullum, in a letter to Mr. Marsham, states, that the key not easily turning round in the lock of one of his garden gates, he looked into the key-hole, and, observing in it something white, ordered the lock to be taken off. When this was done, the lock was found completely full of a downy substance, which contained the chrysalids of the Garden Bee. The down, as Sir Thomas imagined, was that of the *anemone sylvestris*,

* DESCRIPTION. The length of this insect is from half an inch to three quarters of an inch. It is of a dark colour, and hairy. On each side of the abdomen there are several yellow spots.

SYNONYMS. *Apis manicata*. Linn.—L'Abeille à cinq Crochets. Tigny.—Mégachile à cinque Crochets. Latreille.

† *Agrostemma coronaria*, of Linnæus.

of which there were two plants in his garden. He preserved the whole as he found it, but none of the bees contained in it had then made their appearance in a perfect state. This nidus was afterwards sent to the Rev. Mr. Kirby, and five of the chrysalids produced perfect insects; namely, three males, and two females. On comparing the down of which it was composed, with that of the campion, Mr. K. was of opinion, that Sir Thomas Cullum had mistaken its composition, as the down of the anemone is of a more silky texture than that used in this nest. This gentleman informs us, that there were, in the lock, several cells or cases, unconnected with each other, except by the wool, which was their common covering. These cells were of an oval form, and had an exterior coat of wool: under this there was a membranaceous cell, covered with several small vermiform masses of a brown substance, apparently formed of pollen and honey. These were laid, without any regular order, over the cell; and, by means of them, the wool which formed its exterior coat, was made to adhere. At the summit of this membranaceous case there was a small orifice, and within it another cell, somewhat strong and coriaceous, of a brown colour, and shining in the inside as much as if it had been covered with tin-foil. This was supposed to be the cocoon of the larva, previously to its assuming the pupa state.

THE MASON BEE*.

The Mason Bee, which is also one of the solitary species, derives its name from its constructing a nest of mud or mortar. This, on its exterior, has so little of a

* DESCRIPTION. The Mason Bee is about nine lines, or three quarters of an inch in length. Its body is black, and thickly clad with black hairs. The jaws are large and prominent, and terminate in two blunt teeth. The wings are black, with a tinge of violet. The abdomen is somewhat conical, and has underneath a patch of orange-coloured hairs. The termi-

regular appearance, that it is generally regarded as a piece of dirt accidentally adhering to a wall. Within, however, it is furnished with regular cells, each of which affords convenient lodgment to a white larva, much resembling that of the hive-bee. In constructing this nest, which is a work of great labour and art, the female is the sole operator, receiving no assistance whatever from the male.

After having fixed upon an angle, sheltered by any projection, on the south side of a stone wall, or upon some rough part of its surface, she goes in quest of the necessary materials. Her nest is to be constructed of a kind of mortar, of which sand is to be the basis. She is very cautious in her choice of this, and selects it with her jaws, grain by grain. To shorten her labour, before she transports it for use, she glues together, by means of a viscid saliva from her body, as many grains as she can carry: these form a little mass, about the size of a small shot. Taking this up in her jaws, she conveys it to the place she has fixed upon for the site of her house. She labours incessantly till her whole work is completed, which usually occupies five or six days. The number of cells in one nest is from three to fifteen: these are all similar, and nearly equal in dimensions, each being about an inch high, and half an inch in diameter; and, before its orifice is closed, resembling a thimble in shape. When a cell is raised to somewhat more than half its height, the little mason lays up in it a store of pollen, seasoned with honey, for the sustenance of its future inhabitant. This being done, she deposits her egg, finishes and covers her cell, and

nating joints of the legs are reddish.—The *male* is covered with red hairs.

SYNONYMS. *Abeille Maçonne*. *Reaumur*.—It is not known to which of the Linnean species this Bee is to be referred. Fabricius calls it *Apis muraria*: but he has described the male for the female; and *vice versa*, the female for the male.—*Apis muraria*. *Tigwy*.—*Apis comentaria*, *Cuvier*.

then proceeds to the erection of a second, which she furnishes and finishes in similar manner; and so on till the work is completed. The cells are not placed in any regular order: some are parallel with the wall, others perpendicular to it, and others are inclined to it at different angles. This occasions many empty spaces between the cells. These the laborious architect fills up with the same kind of cement, and she then bestows on the whole group a common covering, made with coarser grains of sand; so that at length, the nest becomes a mass of mortar, so hard as not easily to be penetrated even by the blade of a knife.

The nests of the Mason Bees, which sometimes last for several seasons, are often the cause of desperate conflicts. When one insect has taken possession of a nest, and is gone abroad in quest of materials to repair it, another will frequently come to seize upon it. If they meet, a battle invariably ensues. This is always fought in the air. Sometimes the two Bees fly with such rapidity and force against each other, that both fall to the ground. But in general, like birds of prey, the one endeavours to rise above the other, and to give a downward blow. To avoid the stroke, the undermost, instead of flying forward, or laterally, is frequently observed to fly backward. This retrograde flight is likewise performed occasionally by the common house-fly, and some other insects, though we are unable to perceive what stimulates them to employ so uncommon a movement.

From the hardness of the materials with which the Mason Bee constructs her nest, and from the industry and dexterity which she employs to protect her progeny from enemies of every kind, we should naturally imagine that the young-ones would be in perfect safety, and that their castle would be impregnable. But, notwithstanding all these precautions, they are often devoured by the larvæ of a peculiar species of ichneumon fly, the eggs of which are deposited in the cells before the Bee has completed them. They have also an ene-

my even more formidable than the ichneumon. A species of beetle* insinuates its eggs into an unfinished cell: from this proceeds a strong and rapacious grub, which often pierces through every cell in the nest, and successively devours all the inhabitants.

THE WOOD-PIERCING-BEE†.

The operations of the Wood-piercers merit our careful attention. In the spring of the year they frequent gardens, and search for rotten, or at least for dead wood, in order to make a habitation for their young-ones. They usually choose the decaying uprights of arbours, espaliers, or the props of vines; but they will sometimes attack garden-seats, thick doors, and window-shutters.

When the female of this species, (for in her operation she receives no assistance from the male,) has selected some old wooden post suited to her purpose, she begins her work by boring perpendicularly into it; when she has advanced about half an inch, she changes her direction, and then proceeds nearly parallel with its sides, for twelve or fifteen inches, making the hollow about half an inch in diameter. If the wood be sufficiently thick, she sometimes forms three or four of these long holes in its interior; a labour, which, for a single insect, seems prodigious; and in the execution of it some weeks are often employed. On the ground, for about a foot from the place in which one of these Bees is working, little heaps of timber-dust are to be seen. These heaps daily increase in size, and the particles

* *Attelabus apiarius*, of Linnæus.

† DESCRIPTION. These Bees are larger than the queens of the Honey-bee. Their bodies are smooth, except the sides, which are covered with hair.

SYNONYMS. *Apis violacea*. Linn.—L'Abeille perce-bois. Cuvier.—*Xylocopa violette*. Latreille.

that compose them are almost as large as those produced by a hand-saw. The strong jaws of this insect are the only instruments of perforation which she employs. After the holes are prepared, they are divided into ten or twelve separate apartments, each about an inch deep, the roof of one serving for the bottom of another. The divisions are composed of particles of wood, cemented together by a glutinous substance from the animal's body. In making one of these she commences by gluing an annular plate of wood-dust, about the thickness of half-a-crown, round the internal circumference of the cavity: to this plate she attaches a second, to the second a third, and so on till the whole floor is completed. Before each cell is closed, it is filled with a paste composed of the farina of flowers mixed with honey, and an egg is deposited in it. When the larva is hatched, it has scarcely room sufficient to turn itself in the cell; but as the paste is devoured, the space is enlarged so as to allow the animal to perform every necessary operation towards changing its state.

We are informed by M. de Reaumur, that M. Pitot furnished him with a piece of wood, about an inch and a half in diameter, that contained the cells of one of these Bees. He cut off as much of the wood as was sufficient to expose two of the cells to view, in each of which there was a larva. To prevent the injuries of the air, he closed the aperture that he had made, by pasting on it a bit of glass. The cells were at that time almost entirely filled with paste. The two worms were exceedingly small, and, of course, occupied but little space between the walls of the cells and the mass of paste. As the animals increased in size, the paste daily diminished. He began to observe them on the 12th of June; and on the 27th of the same month, the paste in each cell was nearly consumed, and the worm occupied the greatest part of its habitation. On the 2d of July, the provisions of both worms were entirely exhausted. The five or six following days they fasted, which seemed to be a necessary abstinence, during

which they were greatly agitated. They often bent their bodies, and elevated and depressed their heads. These movements were preparatory to the great change which the animals were about to undergo. Between the 7th and 8th of the same month they threw off their skins, and were metamorphosed into nymphs; and on the 30th of July they became perfect insects.

In a range of cells, the worms are necessarily of different ages, and of course of different sizes. Those in the lower cells are older than those in the upper; because, after the Bee has filled with paste, and enclosed the first cell, a considerable time is requisite to collect provisions, and to form partitions for every successive and superior cell. The former, therefore, must be transformed into nymphs and flies before the latter. These circumstances would almost appear to be foreseen by the mother; for if the undermost worm, which is the oldest, and soonest transformed, were to force its way upward, which it could easily do, it would not only disturb, but would infallibly destroy all those lodged in the superior cells. But Providence has wisely prevented this devastation; for the head of the nymph, and consequently of the fly, is always placed in a downward direction. Its first instinctive movements must, consequently, be in that direction. That the young Bees may escape from their respective cells, the mother digs a hole at the bottom of the long tube, which makes a communication between the undermost cell and the open air. Sometimes a similar passage is made near the middle of the tube. By this contrivance, as all the Bees instinctively endeavour to cut their way downward, they find an easy and convenient passage; for they have only to pierce the floor of their cells in order to make their escape, and this they do with their teeth very readily.

THE HIVE BEE*.

* In the formation of their combs, the present insects seem to resolve a problem which would not be a little puzzling to some geometricians, namely: "A quantity of wax being given, to make of it equal and similar cells of a determined capacity, but of the largest size in proportion to the quantity of matter employed, and disposed in such a manner as to occupy in the hive the least possible space." Every part of this problem is completely executed by the Bees. By applying hexagonal cells to the sides of each other, no void spaces are left between them; and, though the same end may be accomplished by other figures, yet such would necessarily require a greater quantity of wax than these. Besides, hexagonal cells are best fitted to receive the cylindrical bodies of the larvæ. A comb consists of two strata of cells, applied to each other's ends. This arrangement both saves room in the hive, and gives a double entry into the cells of which the comb is composed. As a further saving of wax, and for preventing void spaces, the bases of the cells in one stratum of a comb, serve also for bases to the opposite stratum. In short, the more minutely the construction is examined, the more will the admiration of the observer be excited. The walls of the cells are so extremely thin, that their mouths might be thought in danger of suffering by the frequent entering and issuing of the Bees. To prevent this, the Bees make a kind of rim round the margin of each cell, and this rim is three or four times thicker than the walls.

It is difficult to perceive, even with the assistance of

* See Plate xix. *Queen-bee*, Fig. 9. *Male*, Fig. 10. *Female*, Fig. 11.

SYNONYMS. *Apis mellifica*. Linn.—Honey-bee, in various parts of the country.—The males are called *Drones*, and the female the *Queen-bee*. The neuters are called *Working-bees*.—L'Abeille à miel, in France.

glass hives, the manner in which Bees operate when constructing their cells. They are so eager to afford mutual assistance, and for this purpose so many of them crowd together, and are perpetually succeeding each other, that their individual operations can seldom be distinctly observed. It has, however, been discovered that their two jaws are the only instruments they employ in modelling and polishing the wax. With a little patience and attention, we perceive cells just begun: we likewise remark the quickness with which a Bee moves its teeth against a small portion of the cell. This portion the animal, by repeated strokes on each side, smooths, renders compact, and reduces to a proper thinness. While some individuals of the hive are lengthening their hexagonal tubes, others are laying the foundations of new ones. In certain circumstances, when extremely hurried, they do not complete their new cells, but leave them imperfect until they have begun a number sufficient for their present exigencies. When a Bee puts its head a little way into a cell, we easily perceive it, with the points of its teeth, scraping the walls, in order to detach such useless and irregular fragments, as may have been left in the work. Of these fragments the Bee forms a ball, about the size of a pin's head. It issues from the cell, and carries this wax to another part of the work, where it is wanted: it no sooner leaves the cell than it is succeeded by another Bee, which performs a similar office; and in this manner the work is successively carried on, till the cell is completely polished.

Their mode of working, and the disposition and division of their labour, when put into an empty hive, are very wonderful. They immediately begin to lay the foundations of their combs. This is an operation, which they execute with surprising quickness and alacrity. Soon after they have begun to construct one comb, they divide into two or three companies, each of which, in different parts of the hive, is occupied in similar operations. By this division of labour, a great

number of Bees have an opportunity of being employed at the same time, and, consequently, the common work is sooner finished. The combs are generally arranged in a direction parallel to each other. An interval or street between them is always left, that the Bees may have a free passage, and an easy communication with the different combs in the hive. These streets are just wide enough to allow two Bees to pass one another. Besides these parallel streets, the Bees, to shorten their journey when working, leave several cross passages, which are always covered.

They are extremely solicitous to prevent insects of any kind from getting admittance into their hives. To accomplish this purpose, and to shut out the cold, they carefully examine every part of their hive; and if they discover any holes or chinks, they immediately paste them firmly up with a resinous substance, which differs considerably from wax. This substance was known to the ancients by the name of *propolis*, or bee-glue. Bees use the propolis for rendering their hives more close and perfect, in preference to wax, because it is more durable, and because it more powerfully resists the vicissitudes of weather than that. This glue is not, like the wax, formed by an animal process. The Bees collect it from different trees, such as the poplar, birch, and willow. It is a complete production of nature, and requires no additional manufacture from the animals by which it is employed. After a Bee has procured a quantity sufficient to fill the cavities of its two hind-legs, it repairs to the hive. Two of its companions instantly draw out the propolis, and apply it to fill up such chinks, holes, or other deficiencies, as they find in their habitation. But this is not the only use to which Bees apply the propolis. They are extremely solicitous to remove such insects or foreign bodies, as happen to get admission into the hive. When these are so light as not to exceed their powers, they first kill the insect with their stings, and then drag it out with their teeth. But it sometimes happens, that an ill-fated

snail creeps into the hive. This is no sooner perceived, than it is attacked on all sides, and stung to death. But how are the Bees to carry out so heavy a burden? Such a labour would be in vain. To prevent the noxious odours consequent on its putrefaction, they immediately embalm it, by covering every part of its body with propolis, through which no effluvia can escape.

But propolis, and the materials for making wax, are not the only substances, which these industrious animals have to collect. As, during the whole winter, and even during many days in summer, the Bees are prevented by the weather from going abroad in quest of provisions, they are under the necessity of collecting and amassing, in cells destined for that purpose, large quantities of honey. This, by means of their trunk, they extract from the nectariferous glands of flowers. The trunk of the Bee is a kind of rough, cartilaginous tongue. After collecting a few small drops of honey with this, the animal carries them to its mouth, and swallows them. From the gullet they pass into the first stomach. This, when filled with honey, assumes the figure of an oblong bladder, the membrane of which is so thin and transparent, that it allows the colour of the liquid it contains to be distinctly seen. As soon as their stomach is full, the Bees return directly to the hive, and disgorge into a cell the whole of the honey they have collected. It, however, not unfrequently happens, that on its way to the hive the Bee is accosted by a hungry companion. How the one manages to communicate its wants to the other, is not known. But the fact is certain, that when two Bees meet in this situation, they mutually stop, and the one whose stomach is full of honey, extends its trunk, opens its mouth, and, like a ruminating animal, forces up the honey. The hungry Bee, with the point of its trunk, sucks the honey from the other's mouth. When not stopped on the road, the Bee, as before stated, proceeds to the hive, and in the same manner offers its honey

to those who are at work, as if it meant to prevent the necessity of their quitting their labour in order to go in quest of food. In bad weather, the Bees feed on the honey laid up in open cells; but they never touch their reservoirs, while their companions are enabled to supply them with fresh honey from the fields. The mouths of those cells, which are destined for preserving honey during the winter, they always cover with a lid or thin plate of wax.

How numerous soever the Bees in one swarm may appear to be, they all originate from a single parent. It is indeed surprising, that one small insect should, in a few months, give birth to so many young-ones; but, on opening her body at a certain season of the year, eggs to the number of many thousands may be found contained in it.

The queen is easily distinguished from the rest by the size and shape of her body. On her depends the welfare of the whole community; and, by the attention that is paid to all her movements, it is evident how much they depend on her security. At times, attended by a numerous retinue, she is seen in the act of marching from cell to cell, plunging the extremity of her body into each of them, and leaving in each an egg.

A day or two after this egg is deposited, the grub is excluded from the shell, having the shape of a maggot rolled up in a ring, and lying softly on a bed of a whiteish-coloured jelly, on which it begins to feed. The common Bees then attend with astonishing tenderness and anxiety: they furnish it with food, and watch over it with unremitting assiduity. In about six days the grub attains its full growth, when its affectionate attendants shut up the mouth of its apartment with wax, in order to secure it from injury. Thus enclosed, it soon begins to line the walls of its cell with a silken tapestry, in which it undergoes its last transformation.

When it first crawls forth a winged insect, it is very weak and inactive; but, in the course of a few hours, it acquires strength enough to fly off to its labour.

On its emerging from the cell, the officious Bees flock round it, and lick up its moisture with their tongues. One party brings honey for it to feed upon; and another is employed in cleansing the cell, and carrying out the filth, for the purpose of preparing it for a new inhabitant.

The neuter Bees in a hive amount to the number of 16,000 or 18,000. These are all armed with stings. The males are called *Drones*: they are unarmed, and are always killed by the neuters, about the month of September.

Mr. Wildman, whose remarks on the management of Bees are well known, possessed a secret by which he could at any time cause a hive of Bees to swarm upon his head, shoulders, or body, in a most surprising manner. He has been seen to drink a glass of wine, having at the same time the Bees all over his head and face more than an inch deep: several fell into the glass, but they did not sting him. He could even act the part of a general with them, by marshalling them in battle-array upon a large table. There he divided them into regiments, battalions, and companies, according to military discipline, waiting only for his word of command. The moment he uttered the word *march!* they began to march in a regular manner, like soldiers. To these insects he also taught so much politeness, that they never attempted to sting any of the numerous company, which, at different times, resorted to admire this singular spectacle.

THE CARDING BEE*.

Nearly all the Carding Bees perish in the winter: a few of the females only survive. These usually make

* DESCRIPTION. This Bee is yellow, with the hair of the thorax somewhat fawn-coloured.

SYNONYMS. *Apis muscorum*. Linn.—Bourdon des Mousses. Latreille.

their appearance early in the spring, as soon as the catkins of the willows are in blossom; upon which, at this time, they may be seen collecting honey from the female, and pollen from the male catkins.

The neuters do not appear till the spring is somewhat advanced; and the males are most common in autumn, when the thistles are in blossom, upon the flowers of which they are abundant, sometimes appearing to be asleep, or torpid, and, at other times, acting as if they were intoxicated with the sweets they have been imbibing.

When these animals, of any sex, are walking on the ground, if a finger be moved to them, they lift up three legs on one side, by way of defence; which gives them a very grotesque appearance.

Their nests are usually formed in meadows and pastures, sometimes in groves and hedge-rows, where the soil is entangled with roots; but now and then these are found in heaps of stones. When they do not meet with an accidental cavity ready made, the Carding Bees, with great labour, excavate one. This they cover with a thick convex vault of moss, sometimes casing the interior with a kind of coarse wax, to keep out the wet. At the lower part of the nest there is an opening for the inhabitants to go in and out at. This entrance is often through a long gallery, or covered way, a foot or upwards in length, by which the nest is concealed from observation.

The mode in which they transport the moss employed in the formation of their nest, is singular. When they have discovered a parcel fitted to their purpose, and conveniently situated, they place themselves in a line, with their back turned towards the nest. The foremost lays hold of some with her jaws, and clears it, bit by bit, with her fore feet. When this is sufficiently disentangled, she drives it with her feet under her body, and as far as possible beyond, to the second Bee. The second pushes it on to the third, and so on. Thus small heaps of prepared moss are conveyed, by a file

of four or five insects, to the nest, where they are wrought and interwoven with the greatest dexterity by those that remain within.

The nests are often six or seven inches in diameter, and elevated to the height of four or five inches above the surface of the ground. When the covering of moss is taken up, an irregular comb presents itself, composed of an assemblage of oval bodies disposed one against the other. Sometimes there are two or three combs, placed on one another, but not united. These combs vary in size: they consist of several oblong or oval cells or cocoons, of a silky substance, fastened together, and spun by the larvæ when they are about to undergo their first change. These cells are of three dimensions, answering to the three sexes. The void spaces between the cells are filled with masses of brown paste, made of gross wax, or pollen much wrought, and honey. Besides the masses, they attach to every comb, particularly the uppermost, three or four cells of coarse wax, in the shape of goblets, open at the top; and these they fill with liquid and very sweet honey. The first step towards furnishing a nest is to make a mass of the brown paste, and one of these honey-pots. The masses of paste are intended for the food of the larvæ, and in them the eggs are deposited. They vary in number; from three to thirty being to be found in one mass, but not all in the same cavity.

The larvæ are similar to those of the Hive Bee, but their sides are marked by irregular transverse black spots. After they are hatched, they separate from each other, eating the paste that surrounds them. The honey-pots may be intended to supply honey for the occasional moistening of the paste in making repairs, &c. The *pupa* in each cell is placed with its head downward; and the Bee, when it comes to life, makes its way out at the bottom of its cocoon.

The nests seldom contain more than fifty or sixty inhabitants; and both the males and females act in concert with the neuters, in fitting up or repairing their

habitations. The nests of the Carding Bees are exposed to various depredators; but field-mice and polecats are their most formidable enemies.

THE ORANGE-TAILED BEE*.

The nest constructed by this Bee is an edifice of elegant appearance, being of an oval form, and composed of bits of the larger mosses, closely and neatly compacted together. A small round hole or entrance is left on one side. These nests are about four inches in diameter on the exterior, and are generally formed on dry shady banks, in woods, lanes, or meadows. The food laid up for the larvæ, consists of a kind of honey of a brownish colour, disposed in somewhat irregular masses or heaps: for these Bees do not form any regular cells or combs, like some of the others.

OF THE ANTS IN GENERAL.

All the species of Ants known in this country are gregarious; and, like the bees, consist of males, females, and neuters: the latter alone are the labourers. These build in the ground an oblong nest, in which there are various passages and apartments. In the formation of the nest every individual is occupied: some are employed in securing a firm and durable ground-work, by mixing the earth with a sort of glue produced in their bodies: others collect little bits of twigs to serve as rafters, placing them over their pas-

* DESCRIPTION. This is one of the largest of the British Bees; but it varies in size, being sometimes half an inch, and sometimes an inch in length. Its body is black or dark brown, and hairy; and the extremity of the abdomen of a bright orange colour. The wings are light brown.

SYNONYMS. *Apis lapidaria*. *Linnaeus*.—Red-tailed Bee. Great Orange-tailed Garden Bee. *Shaw's Nat. Mis.*—L'Abeille lapidaire. *Tigny*.—L'Abeille des Pierres *Cuvier*.—Bourdon des Pierres. *Latreille*.

sages, to support the covering: others again lay pieces across these, and place on them rushes, weeds, and dried grass. The latter they secure so firmly, as completely to turn off the water from their magazines.

From the eggs of these insects proceed the larvæ, a small kind of maggots without legs, which soon transform into white chrysalids. The latter are generally called *Ants' eggs*, and are frequently used for the feeding of young pheasants, partridges, and nightingales.

The males are much smaller than the females, and seldom frequent the common habitation. All the labour which the females undergo, is the laying of eggs; and the cold weather of winter always destroys them. The neuters, or labouring Ants, which alone are able to struggle through the winter, pass this season in a torpid state. The females and neuters are each armed with stings.

We are told that a very grateful acid is to be obtained from Ants by distillation; and we have one instance of a person being fond of eating them alive. As Mr. Consett was walking with a young gentleman in a wood near Gottenburgh in Sweden, he observed him sit down on an ant-hill, and with great apparent pleasure devour these insects, first nipping off their heads and wings. The flavour, according to his account, was an acid somewhat resembling, though much more agreeable, than that of a lemon.

It is said that the Ants of *tropical climates* are never torpid; that they build their nests with a dexterity, lay up provisions, and submit to regulations, that are entirely unknown among those of Europe. They are, in every respect, a more formidable race. Their stings produce insupportable pain, and their depredations do infinite mischief. Sheep, hens, and even rats, by loitering too near their habitations, are often destroyed by them.

THE HORSE EMMET, OR GREAT HILL-ANT*.

It is chiefly near the old and decayed trunks of trees that the Hill-ants form their settlements. Their nest consists of a great number of apartments. In these they have their magazines, and bring forth and rear their offspring.

It is the peculiar habit of the Hill-ants to collect a vast quantity of pieces of dry sticks, chips, bits of straw, and other rubbish, which they carry to the surface of their colonies, and there place together in heaps, which sometimes become immensely large. This employment they renew every spring, and continue through the whole summer. It is not a little curious to observe from what distances they will bring, and with what dexterity they manage, sticks an inch or two in length.

A gentleman of Cambridge one day remarked an Ant dragging along what, with respect to its strength, might be denominated a piece of timber. Others were severally employed, each in its own way. Presently this little creature came to an ascent, where the weight of the wood seemed for a while to overpower him: he did not remain long perplexed with it; for three or four others, observing his dilemma, came behind and pushed it up. As soon, however, as he had got it on level ground, they left it to his care, and went to their own work. The piece he was drawing, happened to be considerably thicker at one end than the other. This soon threw the poor fellow into a fresh difficulty: he unluckily dragged it between two bits of wood. After several fruitless efforts, finding it would not go through, he

* See Plate xix. Fig. 8.

DESCRIPTION. This is a large species. The antennæ and head are blackish; and the thorax the same, but testaceous beneath. The abdomen is dark brown; and the legs are ferruginous. The wings are transparent, veined with black.

SYNONYMS. *Formica Herculanea?* La Fourmi Hercule. *Tigny.*—Hill-Ant. Gould.

adopted the only mode that even a reasoning being, in similar circumstances, could have taken; he came behind it, pulled it back again, and turned it on its edge; when, running again to the other end, it passed through without difficulty.

The same gentleman says, that, sitting one day in the garden of his college, he was surprised by remarking a single Ant busily employed in some work that caused him to make many journeys to and from the same place. This gentleman traced him to the entrance of the habitation of a community, whence he observed him to take the dead body of an Ant in his fangs, and run away with it. He carried it to a certain distance, dropped it, and returned for another, which, by the time of his arrival, was brought to the same hole. This work was continued as long as the gentleman had time to remain near them.

The use of the before-mentioned collection of sticks and rubbish seems, in a great measure, to consist in aiding to guard the nests from foreign invasion. They seem also to be of use in promoting the maturity of the *pupæ*; numbers of which, in the summer-time, may be found interspersed among the rubbish.

During the warm season of the year, the Hill-ants, every morning, bring up their maggots and *pupæ* nearly to the surface; so that, from ten in the morning until about five in the afternoon, these may always be found lodged just under the surface of the ground. And if their mounts be examined about eight in the evening, the insects will be found to have carried them all down; but, if rainy weather be coming on, it will even be necessary to dig a foot or two deeper than usual to find them.

The Hill-ants have a very odd and diverting propensity. One of them may frequently be observed in the act of running backward and forward with another Ant in its mouth. This is not intended, as might be supposed, for prey; for it is soon afterwards liberated, in a friendly manner, without having sustained any injury.

This amusement, or whatever else it may be termed, is often repeated.

THE RED ANT*.

The lodgments of this species are often found under flat stones and rubbish; and not unfrequently in the forsaken habitations of moles. In the latter of these situations, the process of forming their nest is curious. They cut the earth into small parcels, and incrust these with the blades of grass. As the blades, towards the month of June (when this work is in progress) grow every day, so the Ants advance their labours in proportion. By this contrivance, in somewhat more than a month they have a number of little mounts, each about six inches high. The architecture of these is slight, and the demolition easy; but, without any serious accident, they last long enough to answer every purpose for which they were formed. The nests of such Red Ants as reside under stones or pavements, in old walls, or under rubbish, do not require out-works, and consequently the insects do not here form them, but are content with the covering they find.

In collecting their stores, these creatures may often be observed in full employment; one of them loaded with a grain of wheat, another with a dead fly, and several together hauling along the body of some larger insect. Whenever they meet with any food too large to admit of being dragged away, they devour so much of it upon the spot, as to reduce it to a bulk sufficiently small for them to carry.

In all their excursions they have some object in view: and they seldom return to the nest without either

* DESCRIPTION. This species is considerably smaller than the last. Its general colour is red. The eyes and a spot under the abdomen, are black.

SYNONYMS. *Formica rubra*. Linn.—*La Fourmi rouge*. Cuvier.

themselves bearing something, or without news that something of use has been discovered, in which joint assistance is necessary. If information be brought that a piece of sugar, or bread, or any kind of fruit, has been discovered, even in the highest story of a house, they range themselves in a line, and follow their leader to the spot. Of this, the following is a remarkable instance, related by Dr. Franklin: Believing that these little creatures had some means of communicating their thoughts or desires to one another, he tried several experiments with them, all of which tended to confirm his opinion; but one seemed more conclusive than the rest. He put a little earthen pot, containing some treacle, into a closet: here a number of Ants collected, and devoured the treacle very quickly. But, on observing this, he shook them out, and tied the pot with a string to a nail, which he had fastened into the ceiling; so that it hung down by the string. A single ant, by chance, remained in the pot: this Ant ate till it was satisfied; but when it wanted to get off it could not, for some time, find a way out. It ran about the bottom of the pot, but in vain: at last, after many attempts, it found the way to the ceiling, by going along the string. After it was come there, it ran to the wall, and thence to the ground. It had scarcely been away half an hour, when a great swarm of Ants came out, got up to the ceiling, and crept along the string into the pot, and began to eat again. This they continued to do, until the treacle was all devoured; in the mean time one swarm running down the string, and the other up.

THE SUGAR-ANT*.

It is stated, that these Ants, which have obtained

* DESCRIPTION. The Sugar-ants are of a black colour, and have their antennæ and mandibles rufous.

SYNONYM. *Formica saccharivora*. Linn.

their name from the ruinous devastations they commit on the sugar-cane, first made their appearance in Grenada about fifty years ago, on a sugar-plantation at Petit Havre, a bay five or six miles from the town of St. George. From this plantation they continued to extend themselves on all sides, for several years; destroying in succession every sugar-plantation between St. George's and St. John's, a space of about twelve miles. At the same time colonies of them began to be observed in other parts of the island.

All attempts of the planters to put a stop to the ravages of these insects having been found ineffectual, an act was passed by the legislature, entitling the discoverer of any practicable method of destroying them, to a reward of *twenty thousand pounds*, to be paid from the public treasury of the island.

Many were the candidates for this reward, but very far were any of them from having a just claim to it. Considerable sums of money were, however, granted, in consideration of trouble and expenses in making experiments.

The numbers of these ants were incredible. The roads have been seen covered with them for miles; and so crowded were they in many places, that the print of the horses' feet would appear for a moment or two, till filled up by the surrounding multitudes. All the other species of ants, although numerous, were circumscribed, and confined to a spot, in proportion to the space occupied by the Sugar-ants.

Their destruction was attempted chiefly by poison, and the application of fire. Corrosive sublimate and arsenic, mixed with animal substances, were greedily devoured by them. Myriads were thus destroyed; yet it was found that these poisons could not be laid in sufficient quantities, even to give the hundred-thousandth part of them a taste. The use of fire afforded a greater probability of success. When wood was burnt to the state of charcoal, without flame, and immediately taken from the fire, and laid in their way,

they crowded to it in such astonishing numbers, as soon to extinguish it, although with the destruction of thousands of the insects. Holes were therefore dug at proper distances, and a fire was made in each of them. Prodigious quantities perished in this way; for the places of those fires, when extinguished, appeared in the shape of mole-hills, from the numbers of dead bodies heaped on them. Nevertheless, the ants appeared again as numerous as ever.

This calamity, which long resisted the efforts of the planters, was at length removed by another, which, however ruinous to the other islands in the West Indies, and in some other respects, was to Grenada a great blessing; namely, the hurricane in 1780. Without this, it is probable that the cultivation of the sugar-cane in the most valuable parts of that island, must have, in a great measure, been laid aside, at least for some time.

These ants make their nests only under the roots of particular plants and trees, such as the sugar-cane, the lime, lemon, and orange-trees, where they are protected from the winds and rain; and the mischief done by them is not occasioned by their devouring those plants, but by the lodgments which they form at their roots.

By the violence of the tempest, trees and plants (which commonly resist the ordinary winds) were torn out by the roots. The canes were universally twisted about, as if by a whirlwind, or torn out of the ground altogether; and a deluge of rain falling at the same time, the destruction of nearly the whole progeny appears to have been thereby effected.

THE YELLOW ANTS AND BLACK ANTS OF SOUTH AMERICA.

Dampier, speaking of the natural productions in the Spanish settlements of South America, says, that there were vast swarms of different kinds of ants. Of these, the small Yellow Ants inflicted the most painful

wounds, their sting being like a spark of fire. They were so thick among the boughs in some places, that a person standing beneath, was sometimes almost covered with them, before he was aware. These creatures have nests on great trees, placed on the body between the limbs: some of their nests are as big as a hogshead. This is their winter habitation; for in the wet season they all repair to these their cities, where they preserve their eggs.

"In the dry season, when they leave their nests, they swarm all over the woodlands; for they never trouble the savannahs: great paths, three or four inches broad, made by them, may be seen in the woods. They go out light, but bring home heavy loads on their backs, all of the same substance, and equal in size. I never (continues this celebrated voyager) observed any thing besides pieces of green leaves, so big, that I could scarcely see the insect for his burthen; yet they would march stoutly, and so many were pressing forward, that it was a very pretty sight, for the path looked perfectly green with them.

"There was one sort of ants of a black colour, tolerably large, with long legs. These would march in troops, as if they were busy in seeking somewhat: they were always in haste, and always followed their leaders, let them go where they would. They had no beaten paths to walk in, but rambled about like hunters. Sometimes a band of these ants would happen to march through our huts, over our beds, or into our pavilions, nay, sometimes into our chests, and there ransack every part; and wherever the foremost went, the rest all came after. We never disturbed them, but gave them free liberty to search where they pleased; and they would all march off before night. They were so very numerous, that they would sometimes be two or three hours in passing, though they went very fast."

THE GREEN ANTS, BLACK ANTS, AND RED ANTS,
OF NEW SOUTH WALES.

The following is an account of three different kinds of ants, that were observed in New South Wales, by the gentlemen who accompanied the expedition under Captain Cook:

"Some (says the writer) are as green as a leaf, and live upon trees, where they build their nests of various sizes, between that of a man's head and his fist. These nests are of a very curious structure: they are formed by bending down several of the leaves, each of which is as broad as a man's hand, and gluing the points of them together, so as to form a purse. The viscous matter used for this purpose, is an animal juice, which nature has enabled them to elaborate. Their method of first bending down the leaves, we had no opportunity to observe; but we saw thousands uniting all their strength to hold them in this position, while other busy multitudes were employed within, in applying this gluten, that was to prevent their returning back. To satisfy ourselves that the leaves were bent and held down by the effort of these diminutive artificers, we disturbed them in their work; and as soon as they were driven from their station, the leaves on which they were employed, sprang up with a force much greater than we could have thought them able to conquer by any combination of their strength. But, though we gratified our curiosity at their expense, the injury did not go unrevenged; for thousands immediately threw themselves upon us, and gave us intolerable pain with their stings, especially those which took possession of our necks and hair, from whence they were not easily driven. Their sting was scarcely less painful than that of a bee; but, unless it was repeated, the pain did not last more than a minute.

"Another sort are quite black, and their operations and manner of life are not less extraordinary. Their

habitations are the inside of the branches of a tree, which they contrive to excavate, by working out the pith almost to the extremity of the slenderest twig; the tree at the same time flourishing, as if it had no such inmate. When we first found the tree, we gathered some of the branches, and were scarcely less astonished than we should have been, to find that we had profaned a consecrated grove, where every tree upon being wounded gave signs of life; for we were instantly covered with legions of these animals, swarming from every broken bough, and inflicting their stings with incessant violence.

"A third kind we found nested in the root of a plant, which grows on the bark of trees in the manner of mistletoe, and which they had perforated for that use. This root is commonly as big as a large turnip, and sometimes much bigger: when we cut it, we found it intersected by innumerable winding passages, all filled with these animals, by which, however, the vegetation of the plant did not appear to have suffered any injury. We never cut one of these roots that was not inhabited, though some were not bigger than a hazel nut. The animals themselves are red, and very small, not more than half as big as the common red Ant in England. They had stings, but scarcely force enough to make them felt: they had, however, a power of tormenting us in an equal, if not in a greater degree; for, the moment we handled the root, they swarmed from innumerable holes, and, running about those parts of the body that were uncovered, produced a titillation more intolerable than pain, except it is increased to great violence."

Dipterous Insects*.

OF THE OESTRI, OR GAD-FLIES†.

From the posterior part of the body of the Gad-flies, issues a wimble of wonderful structure. It is a scaly cylinder, composed of four tubes, which draw out like the pieces of a spying-glass. The last of these is armed with three hooks, and is the gimlet with which the insect bores through the tough hide of horned cattle, for the purpose of depositing there her egg. When this is hatched, the grub feeds on the matter issuing from the wound; and the nidus forms upon the body of cattle a lump, sometimes above an inch high. Some of the species deposit their eggs in the nostrils of sheep, and others, in places from which the larvæ, as soon as hatched, can be conveyed into the intestines of horses.

The larvæ are without feet, short, thick, soft, and annulate. When full grown, they let themselves fall to the earth, and they generally pass their chrysalid state under cover of the first stone they meet with.

THE OX GAD-FLY‡.

The eggs of the present species are deposited in the

* The Linnean order *Diptera*, comprises those insects that have only two wings, each furnished at its base with a poise or balancer.

† The mouth in the Oestri is merely a simple aperture. They have two feelers, but no beak. The antennæ are short, and consist of three articulations, the last of which is nearly globular, and furnished with a bristle on the fore-part: they are placed in two hollows on the front of the head. The face is broad, depressed, vesicular, and glaucous, and has been thought to have a distant resemblance to that of an ape.

‡ See Plate xviii. Fig. 6.

DESCRIPTION. This insect has brown unspotted wings, and

back of the ox: and the larvæ lives beneath the skin, between this and the cellular membrane. Its sac or abscess is somewhat larger than the insect, and by narrowing upwards, it opens externally to the air by a small aperture.

The larva is smooth, white, and transparent, when young; but, when full grown, it is of a deep brown. It is also furnished in this state with innumerable minute hooks, ranged in contrary directions on its body; with which, by occasionally erecting or depressing them, it is moved about in the abscess; and from this motion, and the consequent irritation, a greater or less copious secretion of pus takes place for its sustenance.

When the larva is full grown, it effects its escape from the abscess, by pressing against the external opening. When this becomes of sufficient size, it writhes itself through, and falls from the back of the animal to the ground; and, seeking a convenient retreat, becomes a chrysalis. After the exit of the larva, the wound in the skin is generally closed up and healed in a few days.

The Ox Gad-fly is the largest of the European species, and is very beautiful. When the perfect insect leaves the chrysalis, it forces open a very remarkable marginated triangular lid, which is situated on one side of the small end.

The pain it inflicts in depositing its egg, is supposed to be very severe, since, whenever an ox or a cow is attacked by this fly, the presence of the insect is easily known by the extreme terror and agitation of the whole herd. The unfortunate object of attack runs bellowing from among them to some distant part of the heath, or

the abdomen is marked with a black band in the middle, and has dusky yellow hairs at the tip. The front is white, and covered with down; and the thorax is yellowish before, black in the middle, and cinereous behind. The female differs from the male, in having a black style at the extremity of the abdomen.

SYNONYMS. *Oestrus bovis*. Linn.—*L'Oestre des Bœufs*. Latreille.

the nearest water, while its tail, from the severity of the pain, is held with a tremulous motion straight from the body, in the direction of the spine, and the head and neck are also stretched out to their utmost length. The rest, from fear, generally follow to the water, or disperse to different parts of the field.

Such is the dread that cattle have of these flies, that, when one of them has met a herd in their way home from the labour of the day, they have been known to turn back in the utmost affright, regardless entirely of the stones, sticks, and noise of their drivers; and to proceed, without stopping, to some retreat in the water, where they could be secure from its attacks. All flies of this tribe have such an antipathy to water, as never to follow them there.

When oxen are yoked to the plough, the attack of this fly is attended with real danger: they become perfectly uncontrollable, and will often run with the plough directly forward, even through the hedges of the field. To many ploughs there is, on this account, a contrivance to set the animals at liberty the moment they are alarmed.

The female fly is very quick in her operation of depositing the egg; she does not remain on the back of the animal more than a few seconds. The larvæ of this insect are known among the common people, by the name of *Wornuls*, *Wormules*, *Warbles*, or *Bots*.

THE HORSE GAD-FLY*.

The larvæ of this fly are commonly found in the sto-

* See Plate xviii. Fig. 7.

DESCRIPTION. This Gad-fly is distinguished from the rest of its tribe, by having a black band in the middle, and two dots at the tip of its whitish wings. The abdomen is yellow brown, with black spots at the division of the segments. The female is more brown than the male, and has her abdomen elongated with a cleft terminal style.

SYNONYMS. *Oestrus equi*. *Linn.*—*L'Oestre du fondement* des Chevaux, in France.

mach of horses, and sometimes, though less frequently, in the intestines. Here they hang in clusters of from half a dozen to more than a hundred, adhering to the inner membrane of the stomach, by means of two small hooks or tentacula at their heads, whose points turn outward.

When they are removed from the stomach, they will attach themselves to any loose membrane, even to the skin of the hand. To do this, they draw back their hooks, almost entirely within their skin, till the two points come close to each other; then, keeping them parallel, they pierce through the membrane, and immediately afterwards expand them in a lateral direction, and by these means become perfectly fixed.

Their food is probably the chyle, that white juice which is formed in the stomach by the digestion of the food, and which is afterwards converted into blood. This they suck in at a small longitudinal aperture, situated between the hooks.

From their slowness of growth, and the very small quantity of food they require, it has been found extremely difficult to destroy the larvæ of this fly by any medicine or poison, that could be thrown into the stomach. They are, however, not now considered so injurious to horses as they formerly were, and therefore the difficulty of their extirpation seems not a matter of so much consequence as people have imagined.

The mode pursued by the parent-fly to obtain for its offspring a situation in the stomach of the horse, is singular: the female, when the time for laying her eggs is at hand, approaches on wing that part of the horse, where she intends to deposit the egg; this she does with her body nearly upright, and her tail, which is lengthened out for the purpose, bent inwards: she scarcely appears to settle, but merely touches the hair, with the egg held out on the projected point of the abdomen. The egg adheres by means of a glutinous liquor secreted with it. She then leaves the horse, goes to a little distance, and prepares a second egg; then, poisoning

himself near the part. Insects thus in the same way. The liquor dries, and the egg becomes firmly glued to the hair: this is repeated on various flies, till 400 or 500 eggs are sometimes laid on one horse.

The inside of the nose is the part on which these flies principally deposit their eggs: and next to this they fix them on the sides, and the back part of the shoulder: but almost always in places that are liable to be licked by the tongue. When these eggs have remained on the hairs four or five days, they become ripe, after which the slightest application of warmth and moisture is sufficient to bring them into life. If at this time the tongue of the horse touch the egg, its lid is thrown open, and a small, active worm is produced, which readily adheres to the surface of the tongue, and is thence conveyed with the food to the stomach.

It is, however, fortunate for the horses, that this insect is exposed to so many hazards, that scarcely one in a hundred arrives at the perfect state of a fly. The eggs, when ripe, often hatch of themselves, and the larvæ crawl about till they die; others are washed off by the water. When in the mouth of the animal, they have to undergo the ordeal of the teeth and mastication; and many pass entirely through the intestines with the food. When the larvæ arrive at full growth, and are voided along with the dung, many are either dropped into mud or water, others are crushed to death by being trod upon, and others are picked up and devoured by birds. The perfect fly is very tender, and but ill sustains the changes of weather; and cold and moisture, in any considerable degree, are probably often fatal to it.

THE SHEEP GAD-FLY*.

The manner in which the Gad-fly of the sheep deposits its egg, has seldom been noticed; nor is it easy,

* DESCRIPTION. The abdomen is spotted with black and white; and the head is white and punctured. The eyes are

from the obscure and rapid motion of this insect, to discern the exact manner in which this is accomplished. The moment the flies touch the noses of the sheep, the animals shake their heads, and strike the ground violently with their fore-feet: at the same time holding their noses to the earth, they run away, looking about them on every side, to see if the flies pursue. They also appear to smell the grass as they go, lest the insects should be lying in wait for them. If they observe one, they gallop back, or take some other direction. As they cannot, like cattle, take refuge in the water, they have recourse to a rut, or a dry dusty road, where they crowd together during the heat of the day, with their noses held close to the ground. This renders it difficult for the fly conveniently to get at the nostril. It is probably from repeated attacks of the gad-fly, and the consequent rubbing against the ground, that the nostril often becomes inflamed and sore.

OF THE TIPULÆ, OR CRANE-FLIES*.

In their general form, the Tipulæ have a general resemblance to the gnats, but they are easily distinguished from those insects, by having expanded wings, and being destitute of the long proboscis which is so conspicuous in the gnats. From the commencement of spring until the beginning of autumn, the larger kinds of Tipulæ are to be seen in great numbers in pastures and meadows. Some of the species lay their eggs upon the ground amongst the grass, and others in the hollows

marbled; and the wings are pellucid, and punctured at the base.

SYNONYMS. *Oestrus ovis*. *Linnaeus*.—*L'Oestre des Moutons*. *Latreille*.

* The Tipulæ have a very short membranaceous proboscis, the back of which is grooved, and receives a bristle. The feelers are two, incurved, thread-shaped, and longer than the head; and the antennæ are, for the most part, filiform.

of decayed trees. The *larvæ* are without feet, soft, and cylindrical.

Both the *larvæ* and *chrysalids* of the smaller *Tipulæ* are found in water, and are very various, both in size and colour. Some are furnished with a pair of arms; and others are enclosed in cylindrical tubes, open at the ends. The latter swim nimbly, but the former always remain in holes which they have formed in the banks of rivulets. Some of the species spin a silken case round part of their body. Their whole frame is, in general, so very tender, that, in some of the species, a touch only is sufficient to crush them.

THE MEADOW CRANE-FLY, OR LONG-LEGS*.

In grass lands and clover stubbles, the grubs or *larvæ* of these flies are often extremely injurious; and even crops of grain, in the vicinity of meadows, are occasionally much damaged by them. They feed on the roots of plants, and destroy the tender shoots, at the time that they are beginning to make their appearance above the surface of the ground.

About the middle of August the females usually commence the operation of depositing their eggs. In this act they bend their tails to the roots of the grass, and move about from place to place, leaving a few eggs in each spot where they alight. The body of each female contains several hundred eggs; and, upon being squeezed, these will quit the tail one by one, with a sudden spring. If the weather be fine, nearly the whole of the eggs are deposited by the end of the first week in September. The *larvæ* or grubs usually begin to quit the

* DESCRIPTION. This insect is eight or nine lines in length. Its body is of a cinereous brown colour. The antennæ in both sexes are filiform. The wings are transparent, and brown on their exterior margin.

SYNONYMS. *Tipula oleracea*. Linn.—La *Tipule* des Près. Tigny.—The *larvæ* has, among farmers, the general name of "the grub."

eggs some time in the month of February, and they continue in this state during the whole of the summer.

In the day-time the larvæ are generally to be found at the depth of from half an inch, to an inch and a half, below the surface of the ground. It is supposed that they do not come much above-ground, even in the night, but that they feed chiefly below the surface.

These insects are destroyed in great numbers by rooks, jackdaws, starlings, lapwings, and other birds.

About the beginning of August they assume their *pupa* state, and before the end of that month become winged insects.

In an excellent paper communicated to the Holderness Agricultural Society, by Mr. Stickney, of Ridgemont, it is stated that, in the destruction of these insects, lime, as had generally been supposed, has not any material effect. Nor does this gentleman imagine, that any other substance can, on an extensive scale, be successfully applied to the soil to destroy them.

THE WHEAT-FLY*.

In July, 1795, Mr. Marsham had been informed, that an insect, which threatened much mischief, had made its appearance among the wheat of a gentleman, a friend of his, in Hertfordshire. Some of the ears were brought to him for examination; and, on opening those that seemed diseased, he found in many an orange-coloured powder, and in several, one or two very minute larvæ of a yellow colour. On applying a magnifier, for they were too minute for examination with the naked eye, he supposed them to be the larvæ of a small species of *Musca*; but they have since been discovered to be a species of Crane-flies. They were thicker at one end

* DESCRIPTION. The Wheat-fly is about the twelfth of an inch in length. Its body and legs are of a dull yellow colour; and the wings are whitish, with a fringed margin.

• SYNONYM. *Tipula Triticæ*. Linn. *Tran.*

than the other: they extended and contracted themselves at pleasure; and had, in addition, a leaping motion, for they frequently sprung full half an inch from the paper on which he examined them. The ears of wheat were put into water, with gauze tied round them; but, notwithstanding this care, the flies escaped, after their development, without being seen. Mr. Marsham wrote to several friends, requesting their attention to this subject; in consequence of which, an accurate investigation was immediately set on foot.

It appears that these larvæ take their station in the longitudinal furrow of the grain, to the bottom of which they seem attached. Here probably sucking the milky juice which swells the grain, and thus depriving it of part, and in some cases, perhaps, of the whole of its moisture, they occasion it to shrink up, and become what the farmers call *pungled*. They infect several grains in the same ear, and some ears have been observed, in which even a fourth of the grain was either destroyed, or very greatly injured by them. The late-sown wheat always appeared the most infected: this was, no doubt, occasioned by the seed of that sown earlier having obtained too great a degree of hardness, before the insects came out, to be liable to injury.

The Rev. Mr. Kirby carefully investigated the habits of these insects; but it was some time before he was able to discover the parent flies, and still longer before he could find them in sufficient number, to allow him to make the necessary observations as to their habits and economy.

In the beginning of June, 1798, however, he chanced to walk through a corn-field in the evening, and, to his great surprise, he observed an innumerable multitude of them flying about in every direction; and, for nearly a month afterwards, he found them in the greatest abundance. They were seldom seen before seven o'clock; at eight the fields appeared to swarm with them, at which hour they were all busily engaged in laying their eggs; and about nine they generally disappeared.

They were so extremely numerous, that if each of them were to have laid its eggs in a different floret, and these eggs had been permitted to produce larvæ, more than half the grain of the adjacent country would have been destroyed. Twelve Wheat-flies have been observed at the same moment laying their eggs in the same ear: but, among all these myriads, not one male could be discovered. During the day-time none of these insects are to be seen, as they then continue lodged, in a state of repose, upon the lower part of the stem. Upon shaking the stalks, however, they will fly about. The female lays her eggs by means of a long retractile tube, which unsheaths an aculeus as fine as a hair, and very long.

These insects would soon become of serious injury to mankind, were not their race kept within due bounds by several natural enemies: some of these devour them, and others (*Ichneumon Tipulæ*) deposit their eggs in the larvæ, the young of which, when hatched there, find a proper nourishment in the bodies of their hosts. This ichneumon is about the size of a Wheat-fly: and in order to observe the manner of the female's depositing her eggs in the caterpillars of the Wheat-fly, Mr. Kirby placed a number of the latter on a sheet of white paper, and then set an ichneumon down in the midst of them. She soon discovered one of the larvæ; when, vibrating her antennæ in an intense degree, she fixed herself upon it, and, bending her abdomen obliquely under her breast, inserted her aculeus into the body of her victim, and there deposited an egg. This being done, she went to a second, which was constrained to undergo the like operation, and so on to all the rest. She never deposited more than one egg in each larva; and when she mounted a larva that had been pricked before, she soon discovered her mistake and left it.

The size of the two insects is so nearly alike, that one young-one only can be nourished by a single larva; and therefore instinct teaches the parent ichneumons to deposit only this number in each.

OF THE FLIES IN GENERAL.*

The appellation of Fly has been given almost exclusively to these insects, probably from their being much more common than any others. The larvæ of some of the species live in water; those of others are found on trees, where they devour aphides or plant-lice; and others in putrid flesh, cheese, &c. Most of the flies are torpid during the winter, and therefore lay up no provision for their nourishment in the cold season. At the decline of the year, when the mornings and evenings become chilly, many of them come for warmth into houses, and swarm in the windows. At first they appear very brisk and alert; but as they become torpid they seem to move with difficulty, and at last are scarcely able to lift their legs. These seem as if they were glued to the glass; and by degrees many of the insects do actually stick on the glass till they die. It has been observed that some of the flies, besides sharp, hooked nails, have skinny palms or flaps to their feet, by which they adhere to glass and other smooth bodies, and walk on ceilings with their backs downward. They are enabled to do this, by the pressure upon those flaps by the atmosphere; the weight of which they easily overcome in warm weather, when they are brisk and alert. But towards the end of the year this resistance becomes too mighty for their diminished strength; and we see flies labouring along, and lugging their feet on windows as if they stuck fast to the glass; and it is with the utmost difficulty they can draw one foot after another, and disengage their hollow caps from the slippery surface. On a principle exactly similar to this it is, that boys, by way of amusement, carry heavy weights, by only a piece of wet leather at the end of a string, clapped close to the surface of a stone.

* The mouth of these insects has a soft, fleshy proboscis, with two equal lips; and the sucker is furnished with bristles. The antennæ are generally very short.

It is a very extraordinary fact, that flies have been known to remain immersed in strong liquors, even for several months, and afterwards, on being taken out, and exposed to the air, have again revived. Some, we are told by Dr. Franklin, were drowned in Madeira wine, when bottled in Virginia to be sent to England. At the opening of a bottle of this wine at a friend's house in London, many months afterwards, three drowned flies fell into the first glass that was filled. The Doctor says, that having heard it remarked that drowned flies were capable of being revived by the rays of the sun, he proposed making the experiment. They were therefore exposed to the sun, upon the sieve which had been employed to strain them from the wine. In less than three hours two of them, by degrees, began to exhibit signs of life. Some convulsive motions were first observed in the thighs; and at length they raised themselves upon their legs, wiped their eyes with their forefeet, and, soon afterwards, flew away. The Rev. Mr. Kirby informs me, that he has made the same observation on flies taken out of home-made wines. He says that many have recovered, after having been twelve months immersed.

THE COMMON FLESH-FLY*.

It is a fact not generally known, that this is a vivipa-

* DESCRIPTION. The Common Flesh-fly is, in appearance, much allied to the large Blue-bottle Flesh-fly†. It is, however, somewhat more slender, and is besides of a grayish tint, occasioned by some irregular and rather long stripes on the corselet running lengthwise, and some still more irregular marks of the same kind on the body; all of them of a cinereous gray colour, separated by a shining brown, which, under certain points of view, appear of a bluish tint. Its legs are black; and the halteres, or balancers under its wings, are whitish; and its reticular eyes are somewhat red.

SYNONYMS. *Musca carnaria*. Linn.—*La Mouche carnasier*, in France.—*La Mouche vivipare*. Cuvier.

† *Musca vomitoria*. Linn.

rous insect, depositing its offspring, in a living state, on the meat in our shambles and larders. The young-ones appear under the same worm-like form, as the grubs produced from the Blue Flesh-fly. They feed as those do, increase in size, undergo all their transformations in the same manner, and even in the fly-state appear but little different.

When the larvæ have attained their full size, (which is generally in seven or eight days,) they quit their food, and wander in search of loose earth or rubbish, in which they bury themselves, and undergo their metamorphoses.

THE HESSIAN FLY*?

Among the various causes of alarm experienced by the farmer in the course of his rural labours, few are more powerful, though many more justly so, than the larvæ or grubs of this little fly. These are lodged and nourished within the stems of wheat and rye, just above the root, which they entirely destroy.

In order to determine the species of this animal, Mr. Markwick planted some diseased roots of wheat in a small flower-pot filled with bran: this pot he covered with gauze, in such a manner that no insect could get in from the outside, nor any escape from within. Not long afterwards he discovered, on the inside of the gauze, three small flies, which he found to be of this species; and, a few days afterwards, three more. There were in the pot six roots of diseased wheat, which thus produced six flies. On examining the roots, he found an empty chrysalis in each.

* **DESCRIPTION.** This fly is not quite the fourth part of an inch in length. Its thorax is dark-coloured, but marked longitudinally with two yellow lines. The grubs are white, about two lines in length, composed of ten rings, and have the head pointed at the end. The chrysalis is yellow, shining, rather more than one line long, and composed of rings.

SYNONYMS. *Musca Pumilionis.* *Linnaeus.*

The principal stems of the corn being entirely destroyed by this grub, gave the crop of wheat belonging to a friend of Mr. Markwick so disastrous an appearance, that scarcely a hope was entertained of any produce: but, after the grub had changed into its chrysalid state, the mischief ceased, and none of the roots were so much injured as to prevent them from throwing out shoots on each side. At harvest-time it was a matter of most agreeable surprise that this should prove a good crop of wheat, with the ears throughout the field large and well filled. The owner even thought it the best crop on his farm, and conjectured that it would produce about three quarters and a half of threshed corn from each acre.

The wheat that was sown early, about the beginning of October, was alone affected by the insect. The reason, probably, was, that the cold at the approach of winter had destroyed all the flies before the late-sown wheat had time to spring out of the ground: consequently, their eggs could not be laid in this. The fly appears to be perfected in May, or the beginning of June.

It was conjectured that this was the *Hessian Fly*, whose depredations in America have been so notorious. If such be the case, Mr. Markwick was of opinion that a little good English husbandry, by keeping the ground in heart, and thus enabling the wounded shoots to repair themselves by strong lateral ones, would prevent any serious alarms.

THE CHEESE-FLY *.

The larvæ of these Flies are the troublesome maggots found in cheese, and so well known to housewives under the name of *Hoppers*. They proceed from eggs

* DESCRIPTION. The Cheese-fly is a small dark-coloured insect, with white wings, each of which has a black rib.

SYNONYM. *Musca Putris*. Linn.

deposited in the crevices or holes of the cheese by the parent fly.

This maggot is surprisingly strong and vigorous, and, when disturbed, leaps to a considerable distance. To do this it erects itself on its tail, and, bending its head into a circle, fixes two black claws, which are situated at the end of the tail, into two cavities formed for their reception at the back of the head. It then exerts its muscular powers, and, in suddenly extending its body, throws itself, for its size, to a vast distance. One of these insects, which was not the fourth of an inch long, has been known to leap thus, out of a box six inches deep, or to twenty-four times its own length.

The rottenness of cheese is in a great measure occasioned by these little maggots; for they crumble the substance of it into small particles, and the smallest tainted spot immediately spreads, when any of them get upon it.

When they are about to change into chrysalids, they desert the cheese, and in three or four days afterward grow stiff and lifeless. The fly bursts through an opening in the skin just at the head, which there divides into two parts. At its first appearance the wings are not fully expanded, but it is able to run about with great activity: the wings expand by degrees, and in the course of a quarter of an hour they are perfected.

In the ovary of a single female, no fewer than two hundred and fifty-six eggs have been found.

THE CHAMÆLEON FLY*.

This is one of our most common two-winged insects. The egg from which it is produced is deposited by the

* DESCRIPTION. The general colour of the Chameleon Fly is black. The scutellum is two-toothed and yellow. On each side of the abdomen there are three triangular yellow spots, and one at the end.

SYNONYMS. *Musca chamæleon*. Linn.—*La grande Mouche armée*. Cuvier.

female in the hollow stalks of reeds and other aquatic plants. From this proceeds a larva of singular structure, which is often to be seen crawling on grass and plants in the vicinity of shallow standing waters, or floating near the surface.

The general colour of the larvæ is greenish brown. Their bodies consist of eleven rings, and their skin somewhat resembles parchment. Though these animals, before their transformation into flies, live in water, air is necessary to their support; and the apparatus with which the Creator has furnished them for that important purpose, deserves our particular notice. The last ring or termination of their bodies is open, and serves as a conductor of air. From this ring proceed a number of hairs, which, when examined by the microscope, are found to be real feathers with regular vanes. In particular situations the larvæ bend the last ring in such a manner as to reach the surface of the water or mud in which they are placed. The feathers prevent the water from entering the tube or organ of respiration; and, when the animal raises the termination of its body to the surface, in order to receive air, it erects and spreads the feathers, and by these means exposes the end of the tube to the atmosphere. When it wishes to descend, it contracts the filaments into the form of a ball, and the bubble of air contained within it serves to keep the body in a vertical position.

If this insect be cautiously cut open, two large vessels, or tracheæ, will be seen on each side to occupy almost one half of the body. Both of these terminate in the open tube, or last ring.

The head of this creature exhibits not less matter of curiosity than its tail. In the middle part of its mouth is placed a hard, pointed, horny substance, immovable, and somewhat resembling the upper mandible in the beak of a bird. On each side of it there is a small and very singular kind of process. This has lately been discovered to answer the purpose of feet, or, perhaps more properly, of arms, by which the animal performs

many of its movements in the water, and by the aid of which only it can move itself forward on dry land. Another principal use of these members seems to be to loosen the mud, for the purpose of allowing the mouth to have a free access to it; performing, in some measure, the same functions in this respect, as the gristle in the nose of a hog. The animal has the power of drawing these organs inward at pleasure, so as to hide them as it were within its cheeks; and from this peculiar position, some persons have said that this larva carries its feet in its mouth.

When the time of its metamorphosis approaches, it leaves the water, and climbing up the side of the bank, chooses a place where it can lie only in part immersed. Here it remains at rest, until it finally attains its chrysalid state. From five to ten days are occupied in attaining its complete form, and becoming a fly. This change always takes place about the middle of July.

THE RAT-TAILED WORM-FLY*.

The larvæ of the present species are usually found in moist places, such as are frequented by the common black or warty lizard; and they never appear on dry ground till about to undergo their first transformation. In this state they somewhat resemble a tadpole in form, the fore-part being soft, thick, and rounded, and the tail small and tapering. They are covered with a viscous fluid, and on that account are generally found encrusted with a coat of dirt. This seems to be their colour till they are washed, when they are found of a transparent white.

The parent fly always lays her eggs in the vicinity of

* DESCRIPTION. The body is downy; and the thorax black, with four yellow lines. The abdomen is yellow, with transverse black lines, connected by a longitudinal stripe.

SYNONYMS. *Musca Pendula*. Linn.—The larva is called by Reaumur, *Queue de rat*.

water. M. Reaumur watched the motions of one of these insects, which he saw flying about a bucket of water that stood in his garden. After often crossing it, she at length descended within its mouth, and then, flying round it several times, stopped about an inch above the surface of the water, and laid, in several places, a little cluster of eggs. These were all deposited where the wood was just damp from the influence of the water below, and invariably in cavities between two adjoining staves, where the water was less likely to be dried up than elsewhere. In this situation the young insects were no sooner extruded from the egg, than they found themselves within reach of the element where they were destined to pass the most considerable part of their lives.

The young-ones are no sooner dropped into the water, than they find themselves endowed with the instinct of searching for their own food, and of employing, in an appropriate manner, all the members of their body to the uses for which they are naturally adapted.

The tail of this insect, like that of the last, is its organ of respiration; and though it is an inhabitant of the water, yet it is a breathing animal, and would soon be suffocated were it to be excluded from access to the air.

Reaumur, in order to observe the economy of these little creatures, which he denominated *Rat-tailed Worms*, collected a great number of them, which he put into a glass vessel filled two inches high with water. At first they were considerably agitated, each apparently searching for a proper place of repose. Some of them swam across, others attached themselves to the sides, and others rested at the bottom of the vessel. In a quarter of an hour, however, they were almost all tranquil, and Reaumur soon discovered the real use of their long tails. On examining the vessel, he found that each of the animals, in whatever situation they were placed, extended its tail exactly to the surface; and that the tail, which was tubular, and open at the extremity, was the organ

by which respiration was performed. In this experiment, the distance from the bottom to the surface was two inches, and, of course, the tails were of an equal length. To discover how far the animals could extend their tails, this ingenious and indefatigable naturalist gradually augmented the height of the water, and the tails uniformly rose to the surface till it was between five and six inches high. When the water was raised higher, the animals quitted their station at the bottom, and either mounted higher in the water, or fixed themselves upon the sides of the vessel, in situations which rendered it convenient for them to reach the surface with the points of their tails. These tails consist of two tubes, each of which is capable of extension and contraction. The first tube is always visible; but the second, which is the proper organ of respiration, is exerted only when the water is raised beyond a certain height. Through this tube the air is conveyed into two large tracheæ, or wind-pipes, within the body of the animal, and thus maintains the principle of life. When the tails are below the surface, the animals occasionally emit small bubbles of air, which are visible to the naked eye, and immediately afterwards they repair to the surface for fresh supplies.

So admirably has Providence furnished animals, in every state of their existence, with the means of obtaining air, that, after the transformation of many insects into chrysalids, they are provided with instruments for that purpose, which did not exist previously to their transformation. These Rat-tailed Worms, soon after they are transformed into chrysalids, instead of a soft, pliable skin, are covered with a hard, crustaceous substance, seemingly impervious to the air; and the tail, which was the wind-pipe of the animal in its first state, gradually disappears. In a few hours, four hollow horns shoot out, two from the fore and two from the under part of what was the head of the animal. These horns, which are hard and tubular, are real wind-pipes, destined for the introduction of air into the chrysalis. They

terminate in as many tracheæ within the body of the animal. This fact affords a strong example of the necessity of air for sustaining the principle of life, even in its lowest condition. After these animals pass from the chrysalid state to that of flies, they are deprived both of their tails and horns. But the Creator, in this last stage of their existence, has not left them without proper resources for the introduction of air into their bodies. Instead of protuberant tracheæ, in the form of tails or horns, they now, like other flies, receive air by means of stigmata or holes, variously disposed over different parts of the body.

These Rat-tailed Worms pass the first and longest part of their lives, which is supposed to be several months, under water. When the time of their transformation approaches, they leave that element, retire into the ground, and there become chrysalids. From this state they are changed into flies, and pass the remainder of their existence in the air.

OF THE TABANUS OR WHAME-FLY TRIBE*.

The insects of the present tribe subsist on the blood of animals, which they suck with great avidity, by means of their proboscis. They are chiefly active during the hottest weather of summer. In most of the species the eyes are beautifully coloured. Wet meadows and moist woods are the places in which they principally abound. The *larvæ* of some of the species live underground.

* The mouth is furnished with a straight, exerted, membranaceous proboscis, which terminates in an ovate knob, and two equal lips. The sucker projects, and is placed in a groove at the back of the proboscis, with a single-valved sheath and five bristles. There are two equal palpi or feelers, which are clavate, and each terminates in a point. The antennæ are short, approximated, and have an elevated tooth at the base.

THE HORSE-FLY*, AND GREEN-EYED WHAME-FLY†.

The puncture of both these insects is extremely keen and painful. During the summer-time, the former torment horses and cattle in such a degree, as sometimes to throw them into a state of the utmost agitation and alarm. They are more abundant in wet meadows and pastures than in other places. Mankind are also not unfrequently attacked by them.

The *Green-eyed* species often torment mankind. Those persons who are accustomed to walk in shady lanes and in woods, during the hot weather of June and July, know well what it is to suffer from their attacks. They conceal themselves in crevices of the bark of trees, or among the foliage, until about noon, from which time until five or six o'clock in the evening, they are often very troublesome. Both species delight in the hottest sunshine, and indeed seldom fly abroad except in fine weather.

In these insects, as in the Gnats, it is to be remarked that the females only are troublesome. The males are found on flowers, from which they appear to derive their whole nourishment. The latter, towards the close of the day, are frequently observed to fly round and round in the air, apparently for the purpose of inviting the females.

M. De Geer was the first naturalist who described

* **DESCRIPTION.** The length of this insect is about eleven lines. The eyes are of a greenish brown colour; and the back of the abdomen is marked with white triangular spots.

SYNONYMS. *Tabanus bovinus.* *Linnaeus.*—*Le Taon des Bœufs.* *Tigny.* *Cuvier.*

† **DESCRIPTION.** The length is about five lines. The head is yellowish, with three black shining dots, forming a triangle on its anterior part. The eyes are of a brilliant yellowish green colour, with some black specks.

SYNONYMS. *Tabanus cæcutiens.* *Linn.*—*Le Taon aveuglant.* *Tigny.*—*Le Taon aveugle.* *Cuvier.*

the larvæ of this tribe of insects. Those of the Horse-fly, as he states, live under the surface of the earth. They are of a yellowish white colour, and destitute of feet, but furnished with a series of fleshy tubercles, which supply the place of feet. Their body is cylindrical, and terminates before in a conical point. The head is small and scaly, furnished with two large hooks, by means of which it is supposed they are enabled to dig their holes in the ground.

They change into *pupæ* under the surface of the earth. After continuing in this state about a month, they break out from their shell, through a longitudinal orifice which they make in the upper part of the thorax, and become perfect insects.

OF THE GNATS IN GENERAL*.

These insects principally frequent woods and watery places, and, in many parts, are known to the country people by the name of *Midges*. They live by sucking the blood and juices of the larger animals.

Their *larvæ* are very common in stagnant waters. The bodies of these are composed of nine segments, the last of which is furnished with a small cylindrical tube, through which they breathe; and they frequently rise to the surface of the water for that purpose. The head of the *chrysalis* is bent towards the breast, so as to throw the thorax in front: in this the respiratory tubes are situated, near the head. The last segment of the abdomen terminates in a kind of flat fin, by means of which the creature performs all its motions in the water.

* The mouth of the Gnats has a long, slender trunk, or flexile sheath, including five pointed bristles; it has also two feelers. The antennæ are generally thread-shaped, but those of some of the males are feathered.

THE COMMON GNAT*.

Few insects are better known than this species of Gnat, and there are not many that afford a more interesting history.

The female deposits her eggs on the surface of the water, and surrounds them with a kind of unctuous matter, which prevents them from sinking; and she at the same time fastens them with a thread to the bottom, to prevent them from being floated away from a place, the warmth of which is proper for their production, to any other where the water may be too cold, or the animals, their enemies, too numerous. In this state, therefore, they resemble a buoy that is fixed by an anchor. As they come to maturity they sink deeper; and at last, when they leave the egg, they creep, in the form of grubs, at the bottom.

From the beginning of May, innumerable larvæ of Gnats may be seen in stagnant waters, with their heads downward, and the extremity of their abdomen at the surface; from the side of this arises a hollow tube, through which they respire. Their heads are armed with hooks, by which they are enabled to seize on insects and bits of grass, on which they feed; and on their sides are four small fins, by the help of which they swim and crawl along. These larvæ retain their form during a fortnight or three weeks, after which they turn into chrysalids; and all the parts of the winged insect are now distinguishable through their thin exterior covering. The place and shape of their respiratory tube are also altered: this is now divided into two parts, and is situated near the head. The chrysalids abstain from eating, and reside almost constantly at the surface of the water; but, on the least motion, they may be seen to unroll themselves from their spiral posi-

* SYNONYMS. *Culex pipiens*. Linn.—Le Cousin commun. Cuvier.

tion, and, by means of little paddles on their hinder part, to plunge to the bottom. In the course of a few days they are transformed into perfect Gnats. The chrysalids swell at the head, and the flies burst from their enclosure. If, at the instant of the change, a breeze springs up, it proves to them a dreadful hurricane, as the water gets into their case, from which they are not yet perfectly loosened; this immediately sinks, and they are drowned.

If Gnats were not devoured by fish, water-fowl, swallows, and other animals, the air would often, from their immense multitudes, become darkened: a few instances have occurred in which this has been the case. In July, August, and September, 1776, at Oxford, Gnats were sometimes seen, towards the evening, in such myriads as literally to darken the rays of the sun; and their repeated bites swelled the exposed parts of the body to an enormous size, and caused the most troublesome and unpleasant sensations. Mr. Swinton, who has given an account of them in the *Philosophical Transactions*, has stated that one evening, about half an hour before sun-set, he was in the garden of Wadham College, when these insects were observed in numbers almost unexampled. Six distinct columns were observed to ascend from the tops of six branches of an apple-tree in an adjoining garden. Two of these columns seemed perfectly erect, three of them were oblique, and one approached somewhat of a pyramidal form. The bodies of some of the Gnats were greatly distended with blood; one considerably larger than the rest, had as much blood expressed from it as besmeared a space three inches square. About thirty years before this period, many columns of Gnats were observed to rise from the top of the cathedral church of Salisbury. At a little distance, they had so great a resemblance to smoke, as, at first, to occasion an alarm that the church was on fire.

It is impossible to behold and not admire the beautiful structure of the proboscis, through which the Gnat

draws the juices that afford it nourishment. The naked eye is only able to discover a long and slender tube, containing five or six spiculæ of exquisite fineness. These spiculæ, introduced into the veins of animals, act like the suckers of a pump, and cause the blood to ascend. The insect injects a small quantity of liquid into the wound, by which the blood is made more fluid. The Gnat, as it sucks, swells, grows red, and does not quit its hold till it has gorged itself. The liquor it has injected causes a disagreeable itching, which may in some degree be removed by volatile alkali, or by immediately rubbing and washing the place with cold water.

Gnats are said sometimes to shine in the dark.

The *Musquito-fly* is nothing more than a large variety of the Common Gnat. These insects are found in great abundance in the woody and marshy parts of all hot climates; and, during the short summer, throughout Lapland, Norway, and Finland, and other countries equally near the Pole.

It is the female only that bites and sucks the blood; and this operation is so severe, as to swell and blister the skin in a violent manner, and sometimes even to leave obstinate sores. Musquetoës are found in such swarms in the woods, that whoever enters them, is sure to have his face covered, and he is scarcely able to see his way before him. A swelling and disagreeable itching immediately follow the puncture, and these are succeeded by small white ulcers. Even gloves are not always found a protection against these troublesome insects.

The Laplanders, whilst employed in the woods, on the necessary business of cutting timber, are unable to take the refreshment of their meals; for their mouths, as soon as opened, would be filled with Musquetoës. If the wind happen to blow briskly, the animals disappear for the time; but no sooner is it again calm than they return, and crowd every place. They also dread-

fully infest the cattle and rein-deer. When these return from the woods, they are found covered with Musquitoes; and, on the insects being swept from their backs and sides, their skins are red with blood.

The lowest class of people, in all the climates where Musquitoes abound, keep them out of their huts, during the day-time, by burning there a continual fire: the Laplander, when in bed, has a better contrivance to defend himself from their stings. He fixes a leather thong to the poles of his tent, this raises his canvass quilt to a proper height, so that its sides or edges touch the ground. Under this he creeps, and passes the night in security. When Mr. Acerbi and his friends arrived in a cottage in the village of Killare, in Lapland, the first favour the women conferred on them, was to light a fire, and fill the room so full of smoke, that it brought tears from their eyes. This was done to deliver them from the molestation of the Musquitoes; and, as a means of effectual prevention, they made a second fire, near the entrance of the apartment, to stop the fresh myriads, which would otherwise have rushed in upon them from without.

The buzzing of Musquitoes is so loud, as to disturb the rest of persons in the night, almost as much as would be done by their bite. The more opulent inhabitants of climates where these insects abound, usually sleep under nets of gauze or n.uslin.

OF THE HIPPOBOSCÆ, OR SPIDER-FLIES*.

The Hippoboscæ form a connecting link betwixt the two-winged and the apterous insects. By some authors they have been denominated *mouches araignées*,

* The mouth is furnished with a short, cylindrical, straight, two-valved sucker; the valves of which are equal. The antennæ are filiform. The feet are armed with numerous claws; and the body is flat and hard.

or *spider-flies*, from a distant resemblance which some of them have to Spiders.

A few of the species are found in woods and marshy places; but the greater number of them infest the bodies either of quadrupeds or birds.

THE FOREST-FLY*.

In the neighbourhood of the New Forest, Hampshire, and in several other parts of England, these insects are extremely numerous during the summer season. They collect, sometimes in great numbers, upon the necks and shoulders, under the belly, on the interior part of the thighs, and under the tails of horses, where they run about with an oblique motion, and feed by sucking the blood of these animals through their proboscis. They adhere so firmly with their claws to the hair, that they cannot, without great difficulty, be driven away; and even if this happen to be done, they almost always return after a short flight. So hard and tough are their skins, that it is almost impossible, by crushing, to kill them; and the almost only effectual mode of destroying them is, to tear off their heads.

To all horses that are unaccustomed to their attacks, the Forest-flies are peculiarly obnoxious, nor is it until after a considerable lapse of time, that high-spirited and tender-skinned animals become reconciled to them.

In the production of their offspring these insects are very peculiar. Each female has but one egg at a time. This is extremely singular in its form and appearance, and, in size, is nearly as large as the belly of the parent. She fastens it to the hairs of the horse, by a

* **DESCRIPTION.** The general colour of the Forest-fly is brown; the thorax varied with pale yellow, and the legs annulate with yellow and brown. The wings are obtuse: they cross each other and are hyaline, with a brown spot near the outer margin. The feet are furnished with four claws.

SYNONYMS. *Hippobosca equina.* Linn.—*L'Hippobosque du Cheval.* Cuvier.

gluey matter with which it is covered, and in some place where it is not liable to be rubbed off. To those persons who might be inclined to consider it impossible for so small an insect to produce from its body so large a substance, it may be observed, that the skin of the Forest-fly is like a bladder or purse, very tough, and capable of great expansion.

I have called the above-mentioned production, the egg of the Forest-fly, but in this particular I do not speak correctly; for it should appear, that the real egg is hatched within the body of the insect, where the larva also completes its growth, and that this substance is the *pupa*, enclosed in a kind of skin, which is so tough and strong, as to be capable of sheltering it from all injury. From its first extrusion it may be observed to have a slight movement, an alternate retracting and expanding of the skin, somewhat similar to the beating of the heart.

At one of the ends there is a kind of valve or cap, divided into two equal pieces. As soon as the insect becomes perfected, it pushes this open with its head, and issues forth.

Forest-flies are occasionally found upon cattle; and, in open countries, even upon dogs.

Apterous Insects*.

OF THE TERMES TRIBE†.

The present tribe is arranged by Linnæus among the

* The Linnean order *Aptera*, comprises all such insects as are destitute of wings in both sexes.

† The mouth is furnished with two horny jaws, and has a

Apterous Insects: but it might with equal propriety have been inserted with the Neuroptera or Hymenoptera; for the males of most of the species, in a perfect state, have either two or four wings.

THE DEATH-WATCH TERMES*.

In old wood, decayed furniture, museums, and neglected books, these insects are almost always to be found; and both the male and female, for the purpose of attracting each other, have the power of making a ticking noise, not unlike that of a watch. When disturbed they are immediately silent; but if viewed without molestation, they not only beat freely, but even answer any person's beating with his nail. At every stroke their body shakes, or seems affected by a sudden jerk; and these jerks succeed each other so rapidly, that it requires great steadiness to perceive, with the naked eye, that the insects are at all in motion. They are seldom heard before the month of July, and never later than the sixteenth of August. It appears strange, that so small an animal as this should be able to make a noise so loud, as sometimes to equal that of the strongest-beating watch. Dr. Derham seems to have been the first naturalist who examined and described this insect. He had often heard the noise, and, in pursuing it, had found nothing but these insects, which he supposed incapable of producing it. One day, how-

a horny four-cleft lip. The feelers are four in number, thread-shaped, and equal. The antennæ in some of the species are beaded, and in others tapering.

* **DESCRIPTION.** This insect is about a tenth of an inch long. At first sight it appears like a louse: its mouth, however, with a glass, is seen to be reddish, and its eyes yellow. The antennæ are sharply pointed. It is sometimes, though very rarely, observed to have wings.

SYNONYMS. *Termes pulsatorium.* Linn.—*Procus pulsatorius.* Fabricius.

ever, finding that the noise proceeded from a piece of paper, in his study window, loosely folded, and lying in a good light, he viewed it through, and with a microscope observed, to his astonishment, a Death-watch *Termes*, in the very act of beating. In some years these insects are more numerous than in others, and their ticking is of course more frequently heard. Dr. Derham says, that during the month of July, in one particular summer, they scarcely ever ceased, either in the day or night.

The females lay their eggs in dry and dusty places, where they are not likely to be disturbed. These are exceedingly small, and, in appearance, resemble the nits or eggs of lice. They are generally hatched about the beginning of March. After leaving the eggs, the animals are so small, as scarcely to be discerned, without the assistance of a glass. They continue in the larva state about two months. They subsist on dead flies and other insects; and, from their numbers and voracity, often commit much damage in cabinets of natural history. They also live on other substances, and may frequently be observed hunting, with great care and attention, for nutritious particles, among the dust in which they are found; turning it over with their heads, and searching among it somewhat in the manner of swine. Many of them live through the winter; but, during that time, in order to avoid the inconveniences of frost, they bury themselves deep in dust.

The Death-watch *Termes* seem to have very little alliance to the following species.

THE WHITE ANTS*.

The animals of this extraordinary community are found in the East Indies, and in many parts of Africa

* SYNONYMS. *Termes fatale*. *Linn.*—*La Thermès fatale*. *Tigny*.

and South America, where their depredations are greatly dreaded by the inhabitants. Mr. Smeathman, whose account of them occupies more than fifty pages in the seventy-first volume of the Philosophical Transactions, says, that they are naturally divided into three orders: 1. The working insects, which he distinguishes by the name of *labourers*; 2. The fighters, or *soldiers*, which perform no other labour than such as is necessary in defence of the nests; and 3. The winged or perfect insects, which are male and female, and capable of multiplying the species. The latter he denominates the *nobility* or *gentry*; because they neither labour nor fight. In their nest or hill, for they build this on the surface of the ground, the labourers are always the most numerous, there being at least a hundred labourers to one of the fighting insects, or soldiers. In this state they are about a quarter of an inch in length.

The second order, or soldiers, differ in figure from the labourers. These appear to be such insects as have undergone one change toward their perfect state. They are now nearly half an inch in length, and are equal in size to about fifteen of the labourers. The shape of the head is likewise greatly changed. In the former state, the mouth was evidently formed for gnawing, or for holding bodies; but, in this state, the jaws being shaped like two sharp awls, a little jagged, are destined solely for piercing or wounding. For these purposes they are well calculated, being as hard as a crab's claw, and placed in a strong horny head, which is larger than all the rest of the body.

The insect of the third order, or in its perfect state, is still more remarkable. The head, the thorax, and the abdomen, differ almost in the same parts as in the labourers and soldiers. The animals are, also, now furnished with four large brownish transparent wings, by which they are enabled, at the proper season, to emigrate, and to establish new settlements. They are likewise greatly altered in their size as well as figure, and have acquired the powers of propagating the spe-

cies. Their bodies now measure nearly three quarters of an inch in length, their wings, from tip to tip, more than two inches and a half, and their bulk is equal to that of thirty labourers, or two soldiers. Instead of active, industrious, and rapacious little animals, they now become innocent, helpless, and dastardly. Their numbers are great, but their enemies are still more numerous: they are devoured by birds, by every species of ants, by carnivorous reptiles, and even by the inhabitants of many parts of Africa. After such devastation, it seems surprising that even a single pair should escape. "Some, however," says Mr. Smeathman, "are so fortunate; and, being found by some of the labouring insects, that are continually running about the surface of the ground under their covered galleries, are *elected* Kings and Queens of new states: all those which are not so elected and preserved, perish. The manner in which these labourers protect the happy pair from their innumerable enemies, not only on the day of the massacre of almost all their race, but for a long time after, will, I hope, (continues this writer,) justify me in the use of the term *election*. The little industrious creatures immediately enclose them in a small chamber of clay suitable to their size, into which at first they leave but one entrance, large enough for themselves and the soldiers to go in and out at, but much too little for either of the royal pair to use; and, when necessity obliges them to make more entrances, such entrances are never larger; so that the voluntary subjects charge themselves with the task of providing for the offspring of their sovereigns, as well as of working and fighting for them, until they have raised a progeny capable of at least dividing the task with them."

About this time a most extraordinary change takes place in the queen. The abdomen begins to extend and enlarge to such an enormous size, that an old queen will sometimes have it so much increased, as to be nearly *two thousand* times the bulk of the rest of her body. It is now of an irregular, oblong shape, and

becomes one vast matrix full of eggs. When these are perfectly formed, they begin to be protruded, and they come forth so quickly, that about sixty in a minute, or upward of eighty thousand in twenty-four hours, are deposited.

The eggs are immediately taken away by the attendants, and carried to the nurseries. Here they are hatched. The young-ones, when they issue forth, are attended and provided with every thing necessary, until they are able to obtain food for themselves, and to take their share in the labours of the community.

The nests, or rather *hills*, of these Ants, (for they are often elevated ten or twelve feet above the surface of the ground,) are nearly of a conical shape; and sometimes so numerous, as at a little distance to appear like villages of the negroes. Jobson, in his History of Gambia, says, that some of them are twenty feet high, and that he and his companions have often hidden themselves behind them, for the purpose of shooting deer and other wild animals. Each hill is composed of an exterior and an interior part. The exterior cover is a large clay shell, shaped like a dome, of strength and magnitude sufficient to enclose and protect the interior building from the injuries of the weather, and to defend its numerous inhabitants from the attacks of natural or accidental enemies.

The royal chamber is always situated as near the centre of the building as possible, is generally on a level with the surface of the ground, and is of an obtuse oval shape within. In the infant state of the colony, it is not more than an inch in length; but in time it becomes enlarged to the length of six or eight inches.

The entrances into the royal chamber, not admitting any animal larger than the labourers or soldiers, it follows that the king and queen can never possibly get out. This chamber is surrounded by many others, of different sizes, figures, and dimensions; all of them arched either in a circular or an elliptical form. These

either open into each other, or have communicating passages; which, being always clear, are evidently intended for the convenience of the soldiers and attendants, of whom great numbers are necessary. The latter apartments are joined by the magazines and nurseries. The magazines are chambers of clay, and are all at times well stored with provisions, which, to the naked eye, seem to consist of the raspings of wood and plants; but, when examined by the microscope, they are found to consist chiefly of the gums or dried juices of plants, thrown together in small irregular masses.

The magazines are always intermixed with the nurseries, buildings totally different from the rest of the apartments. These are composed entirely of wooden materials, which seem to be cemented with gum. They are invariably occupied by the eggs, and by the young-ones, which first appear in the shape of labourers. These buildings are exceedingly compact, and are divided into many small irregular-shaped chambers, not one of which is half an inch wide. They are placed all round, and as near as possible to the royal apartment. When a nest is in an infant state, the nurseries are close to the royal apartment. But, when the body of the queen enlarges, it becomes necessary, for her accommodation, to augment the dimensions of her chamber. She then, likewise, lays a greater number of eggs, and requires more attendants than before; and of course it becomes necessary that both the number and dimensions of the adjacent apartments should be augmented. For this purpose, the small first-built nurseries are taken to pieces, rebuilt a little further off, and made a size larger; and their number, at the same time, is increased. Thus the animals are continually employed in pulling down, repairing, or rebuilding their apartments; and these operations they perform with wonderful sagacity, regularity, and foresight.

The nurseries are enclosed in chambers of clay, like those which contain the provisions; but they are much larger. In the early state of the nest they are not big-

ger than a hazel nut: but in great hills they are often four or five inches across.

The royal chamber, as before observed, is situated as nearly under the apex of the hill as possible, and is surrounded both above and below, by what Mr. Smeathman calls the *royal apartments*, or such as contain only those labourers and soldiers that are employed in defence of the common parents. These apartments compose an intricate labyrinth, which extends a foot or more in diameter from the royal chamber on every side. Here the nurseries and magazines of provisions begin; and, being separated by small empty chambers and galleries, which surround them, and communicate with each other, they are continued on all sides to the outward shell, and reach up within two-thirds or three-fourths of its height, leaving an open area in the middle under the dome. This is surrounded by large pointed arches, which are sometimes two or three feet high next to the front of the area, but diminish rapidly as they recede, and are soon lost among the innumerable chambers and nurseries behind them. The inferior building, or assemblage of nurseries, chambers, and passages, has a flattish roof, without any perforation. By this contrivance, if by accident water should penetrate the external dome, the apartments below are preserved from injury. The area has also a flattish roof, which is situated above the royal chamber. It is likewise water-proof, and so constructed, that, if water get admittance, it runs off by subterraneous passages, which are cylindrical, and some of them are so large as to be twelve or thirteen inches in diameter. These subterraneous passages are thickly lined with clay. They ascend the internal part of the external shell in a spiral form, and, winding round the whole building up to the top, intersect and communicate with each other at different heights. From every part of these large galleries, a number of pipes, or smaller galleries, leading to different apartments of the building, proceed. There are likewise a great number which lead down-

ward, by sloping descents, to a considerable depth under the surface of the ground. Other galleries ascend and lead out horizontally on every side, and are also carried underground, but near the surface, to great distances, for the purpose of foraging.

When a breach is made, by an axe or other instrument, in any of the walls, the first object that attracts attention, is the behaviour of the soldiers or fighting insects. Immediately after the blow is given, a soldier comes out, walks about the breach, and seems to examine the nature of the enemy, or the cause of the attack. He then goes into the hill, gives the alarm, and, in a short time, large bodies of soldiers rush out as fast as the breach will permit. It is not easy to describe the fury that actuates these fighting insects. In their eagerness to repel the enemy, they frequently tumble down the sides of the hill, but quickly recover themselves, and bite every thing they encounter. This biting, joined to the striking of their forceps upon the building, makes a crackling or vibrating noise, which is somewhat shriller and quicker than the ticking of a watch, and may be heard at the distance of several feet. While the attack proceeds, they are in the most violent bustle and agitation imaginable. If they seize hold of any part of a man's body, they instantly make a wound, which gives considerable pain. When they attack the leg, the stain of blood upon the stocking extends more than an inch in width. They make their hooked jaws meet at the first stroke, and never quit their hold, but will suffer themselves to be pulled away, piece after piece, without any attempt to escape. On the other hand, if a person keep out of their reach, and give them no further disturbance, in less than half an hour they retire into the nest, as if they supposed the monster that damaged their castle had fled. Before the whole of the soldiers have got in, the labouring insects are all in motion, and hasten toward the breach, each of them having a quantity of tempered mortar in his mouth. This mortar they stick upon the breach as

fast as they arrive; and they perform the operation with so much dispatch and facility, that, notwithstanding the immensity of their numbers, they never stop or embarrass one another. During this scene of apparent hurry and confusion, the spectator is agreeably surprised to perceive a regular wall gradually rising up and filling the chasm. While the labourers are thus employed, almost all the soldiers remain within, except here and there one, who saunters about among six hundred or a thousand labourers, but never touches the mortar. One soldier, however, invariably takes his station close to the wall which the labourers are building. This soldier turns himself leisurely on all sides, and, at intervals of a minute or two, raises his head, beats upon the building with his forceps, and makes the vibrating noise formerly mentioned. A loud kind of hiss instantly issues from the inside of the dome, and from all the subterraneous caverns and passages. That this hiss proceeds from the labourers is apparent; for, at every signal of this kind, they work with redoubled alacrity. A renewal of the attack, however, instantly changes the scene. "At the first stroke," Mr. Smeathman remarks, "the labourers run into the many pipes and galleries with which the building is perforated; and this they do so quickly, that they seem to vanish; for, in a few seconds, all are gone, and the soldiers rush out as numerous and as vindictive as before. On finding no enemy, they return leisurely into the hill; and, soon afterwards, the labourers appear loaded as at first, with soldiers here and there among them, who act in the same manner as before, one or other of them giving the signal to hasten the business. Thus the pleasure of seeing them come out to fight and to work alternately, may be obtained as often as curiosity excites, or time permits; and it will certainly be found, that the one order never attempts to fight, nor the other to work, let the emergency be ever so great."

It is exceedingly difficult to explore the interior parts of a nest or hill. The apartments which surround

the royal chamber and the nurseries, and, indeed, the whole fabric, have such a dependence on each other, that the breaking of one arch generally pulls down two or three. Another great obstacle is the obstinacy of the soldiers, which, says Mr. Smeathman, "fight to the very last, disputing every inch of ground so well, as often to drive away the negroes who are without shoes, and to make white people bleed plentifully through their stockings. Neither can we let a building stand, so as to get a view of the interior parts without interruption; for, while the soldiers are defending the out-works, the labourers keep barricading all the way against us, stopping up the different galleries and passages which lead to the various apartments, particularly the royal chamber, all the entrances to which they fill so artfully as not to let it be distinguishable while the work remains moist; and, externally, it has no other appearance than that of a shapeless lump of clay. It is, however, easily found, from its situation with respect to the other parts of the building, and by the crowds of labourers and soldiers which surround it, and which exhibit their loyalty and fidelity by dying under its walls. The royal chamber is often capacious enough to hold many hundreds of the attendants, besides the royal pair; and is always found as full of attendants as it can hold. These faithful subjects never abandon their charge even in the last distress; for, whenever I took out the royal chamber, as I often did, and preserved it for some time in a large glass bowl, all the attendants continued to run round the king and queen, with the utmost solicitude, some of them stopping at the head of the latter, as if to give her something. When they came to the extremity of the abdomen, they took the eggs from her, carried them away, and piled them carefully together in some part of the chamber, or in the bowl under, or behind any broken pieces of clay which lay most conveniently for the purpose."

OF THE LOUSE TRIBE.

Lice live on animal juices, which they extract from living bodies by means of their sucker. The *larva* and *pupa* resemble the perfect insect.

The mouth in these animals is formed by a retractile recurved sucker, without a proboscis. There are no feelers, and the antennæ are about the length of the thorax. The abdomen is somewhat flattened; and the legs, which are six in number, are formed not for leaping, but for running and climbing.

THE COMMON LOUSE*.

When we examine the human Louse with the microscope, its external deformity excites disgust. The fore part of its head is somewhat oblong, while the hind part is rounded. The skin is hard and transparent, with here and there a few bristly hairs. On each side of its head are two antennæ or horns, jointed, and covered with bristly hair; and behind these are the eyes, which are large and black. The neck is short, and the breast divided into three parts; on each side of which are three legs, armed at the end with small claws, by which the animal is enabled to lay hold of different objects. The trunk, or proboscis, is generally concealed in its tube: this is very sharp, and furnished, towards its upper part, with a few reversed prickles. By means of this the Louse feeds; and, when it is engaged in sucking any animal, the blood may be seen, through the transparency of its external covering, to rush like a torrent into the stomach. Through the skin its stomach and intestines are visible, as well as the ramifications of the tracheæ or respiratory tubes,

* SYNONYMS. *Pediculus humanus*. Linn.—Le Pou humain, in France.

which appear dispersed, in a beautiful manner, throughout various parts of the animal.

Scarcely any creature multiplies so quickly as this unwelcome intruder. It has been asserted that a Louse becomes a grandfather in the space of twenty-four hours. This fact cannot be ascertained; but nothing is more true than that the moment the nit, which is no other than the egg of the Louse, gets rid of its superfluous moisture, and throws off its shell, it begins in its turn to breed. Nothing so much prevents the increase of this nauseous animal, as cold, and want of humidity. The nits, unless they be laid in a place that is warm, do not produce any thing; and from this it is that many of the nits laid on the hairs in the night-time, are destroyed by the cold of the succeeding day.

In Mexico these animals were so numerous, that the ancient kings found no other means of ridding their subjects of them, than by the imposition of an annual tribute of a certain quantity. Ferdinand Cortes found bags full of lice in the palace of Montezuma.

"This is a creature (says Albin) so officious, that, at one time or other, it will be known to every person; so busy, and so impudent, that it will be intruding itself into every one's company; and withal, so proud and aspiring, that it fears not to trample on the best, and affects nothing so much as a crown. It feeds and lives very high; and that makes it so saucy as to pull any one by the ears that comes in its way; and it will never be quiet till it has drawn blood. It is troubled at nothing so much as that a man scratches his head, as knowing that he is plotting and contriving some mischief against it: this makes it often skulk into some meaner and lower place, and run behind a man's back; hence it is better known than trusted."

OF THE FLEAS IN GENERAL.

The mouth of these insects is without either jaws or feelers: it has only a long, inflected proboscis, which

conceals a single bristle. The antennæ are beaded; the abdomen is compressed sideways; and the legs are six in number, and formed for leaping.

The *larvæ* are white, cylindrical, and without feet, but are very active little creatures. Under the tail there are two small spines. The *chrysalis* is motionless, but in appearance is not unlike the perfect insect. The two following species are all that have been yet discovered.

THE COMMON FLEA*.

Notwithstanding the general disapprobation of this insect, it has certainly something pleasing in its appearance. When examined with a microscope, it will be seen to have a small head, large eyes, and two short, four-jointed antennæ, between which is situated the trunk, or proboscis. The body appears enveloped in a shelly armour, which is always clean and bright: this is beset at the segments with many sharp bristles. All the motions of this insect indicate agility and elegance; and its muscular power is so extraordinary as justly to excite our wonder. We know no animal whose muscular strength can be put in competition with that of a Flea; for, on a moderate computation, it is known to leap to a distance of at least two hundred times its own length.

There is no proportion between the power and the size of the insect tribes. Had man an equal degree of strength, bulk for bulk, with a louse or a flea, the history of Samson would no longer be miraculous. A Flea will drag after it a chain a hundred times heavier than itself; and, to compensate for this power, will eat ten times its own weight of provisions in a day. Mr. Boverich, an ingenious watchmaker, who some years

* SYNONYMS. *Pulex irritans*. *Linn.*—La Puce irritante, in France.

ago lived in London, exhibited to the public a little ivory chaise, with four wheels, and all its proper apparatus, and a man sitting on the box, all of which were drawn by a single Flea. He made a small landau, which opened and shut by springs, with six horses harnessed to it, a coachman sitting on the box, and a dog between his legs: four persons in the carriage, two footmen behind it, and a postillion riding on one of the fore-horses, which was also easily drawn by a Flea. He likewise had a chain of brass, about two inches long, containing two hundred links, with a hook at one end, and a padlock and key at the other, which the Flea drew very nimbly along.

This little animal is produced from eggs which the females stick fast, by a kind of glutinous matter, to the roots of the hairs of cats, dogs, and other animals; or to the wool in blankets, rugs, or other similar furniture. Of these eggs the females lay ten or twelve a day, for several days successively; and they are hatched in the same order, five or six days after being laid.

From the eggs come forth, not perfect Fleas, but little whitish worms, or maggots, whose bodies have annular divisions, and are thinly covered with long hairs. They adhere closely to the body of the animal, or substance, on which they were produced; and feed on the scurfy excretion of the skin, the downy parts of linen, &c. They are very small, but lively and active. When alarmed they suddenly roll themselves into the shape of a little ball. They may be kept in a little box, and fed with dead flies, which they eat with great voracity.

In eleven days from their being hatched, they cease to eat, and lie as though they were dying; but, if viewed in this state with a microscope, they will be found weaving a silken covering around them, in which they are to change into a chrysalid form. They continue nine days in this shape, at first white, and afterwards by degrees darkening their colour as they acquire firmness and strength. As soon as they issue from their

bag, they become perfect Fleas, and are able to leap away.

THE PENETRATING FLEA, OR CHIGOE*.

This is a troublesome insect, too well known in many parts of America. It is so small as to be almost imperceptible. Its legs have not the elasticity of those of fleas; for, if the Chigoes had as great powers of leaping as fleas, few creatures could escape their attack. They are always found among dust, and particularly in filthy places; they fix themselves on the legs, to the soles of the feet, and even to the fingers.

This creature pierces the skin so subtly that the person is not sensible of the attack; nor is this to be perceived till the insect begins to extend itself. At first, it is not difficult to extract it; but, although it may only have introduced its head, it makes so firm a lodgment that a part of the skin must be sacrificed before it will quit its hold.

If it be not soon perceived, the insect completes its lodgment, sucks the blood, and forms its nest of a white, thin tunicle, in the shape of a flat pearl. It extends itself in this space in such a manner that its head and feet are toward the exterior side, for the convenience of nourishment; and the other part of the body is toward the inner side of the tunicle, in order to lay its eggs there. In proportion as these are laid, the little pearl is enlarged; and in four or five days it is at least two lines in diameter. It is then of the utmost importance to have it extracted; for if this be neglected it bursts,

* DESCRIPTION. This insect is chiefly distinguished by the length of its proboscis, which is as long as the body. Its colour is reddish-brown. The abdomen of the female, when with egg, increases to nearly a hundred times the usual size.

SYNONYMS. *Pulex penetrans*. Linn.—Jigger, Nigua, and Pique, in various parts of America. *La Puce penetrante*. Cuvier.

and spreads an infinity of nits, which, when hatched, fill the whole part, and produce excessive anguish; and the difficulty of dislodging them becomes very great. They penetrate to the very bones; and, even when the sufferer has got rid of them, the pain will last until the flesh and skin are entirely healed.

The operation of extracting these insects is long and painful. It consists in separating, with the point of a needle, the flesh next to the membrane where the eggs are lodged; which is not easily done without bursting the tunicle. After having separated even the most minute ligaments, the nest is to be extracted. If unfortunately it burst, particular care must be taken to extract every root of it, and especially not to leave behind the principal insect. This would begin to lay its eggs again before the wound could be healed; and, penetrating much further into the flesh, would increase the difficulty of extracting it. During the great heats, extreme care must be taken not to wet the part affected. Without this precaution, experience has proved that the patient is subject to consequences that frequently prove fatal.

"The Chigoe," says Stedman, "is a kind of small sand-flea, common in Surinam, which gets in between the skin and the flesh without its being felt, and generally under the nails of the toes: where, while it feeds, it keeps growing till it becomes of the size of a large pea, causing no further pain than a disagreeable itching. In process of time its operation appears in the form of a small bladder, in which are deposited thousands of eggs or nits, and which, if it breaks, produce so many young Chigoes, that in course of time create running ulcers, which are often of very dangerous consequence to the patient; so much so, indeed, that he knew a soldier, the soles of whose feet were obliged to be cut away before he could recover; and some men have lost their limbs by amputation, nay, even their lives, by having neglected, in time, to root out these abominable vermin. The moment, therefore, that a redness and

itching, more than usual, are perceived, it is time to extract the Chigoe that occasions them. This is done with a sharp-pointed needle, taking care not to occasion unnecessary pain, and to prevent the chigoe, or bladder, from breaking in the wound. Tobacco ashes are put into the orifice, by which, in a little time, the sore is perfectly healed."

OF THE TICKS IN GENERAL.

These troublesome insects live chiefly on other animals: some of them, however, inhabit the water, and others subsist on various vegetable substances. They are to be found every where, and in immense numbers. The *larvæ* and *chrysalids* have each six feet.

Their mouth is not furnished with a proboscis, but the sucker has a two-valved, cylindrical sheath. They have two compressed feelers, as long as the sucker; two eyes, one on each side of the head; and eight legs.

THE CHEESE-MITE*.

To the naked eye, these minute creatures appear little more than moving particles of dust; but on the application of the microscope they are found to be perfect insects, performing all the regular animal functions.

The females, which are easily distinguished from the males, are oviparous. The eggs are so minute, that on a tolerably accurate calculation it appears, that *ninety millions* of them would not fill the shell of a pigeon's

* **DESCRIPTION.** The head of the Cheese-mite is small in proportion to the rest of the body. Its legs are furnished at the extremities with little claws, by which it is enabled to lay firm hold of the substances it inhabits. The body is furnished with long hairs, which it has the power of depressing; and by this means it is enabled to creep through crevices that would not otherwise admit its body to pass.

SYNONYMS. *Acarus Siro.* Linn.—*La Mitte ciron.* Tigny.

egg. During warm weather they are hatched in about twelve days; but, during winter, the time of hatching is much longer. When the young-ones first come forth they are extremely minute; and before they attain their full size, they cast their skins several times.

Mites are very quick-sighted; and when once they have been touched with a pin, it is easy to perceive a great degree of cunning exerted to avoid a second touch. They are extremely voracious animals, and are often observed even to devour each other; and so very tenacious are they of life, that they have been kept alive many months between two concave glasses, by which they were applied to a microscope. Leeuwenhoek placed a female Mite on the point of a pin for examination: she remained there ten days, and during the time laid two eggs; which, for want of other food, she devoured.

THE DOG-TICK *.



In thickets and heaths these Ticks are sometimes very abundant. Hence it is that animals which frequent such places, and particularly dogs of the chase, are much exposed to their attacks.

Their abdomen is quite flat and thin when they have been long without nourishment; but, when adhering to the body of an animal, they soon fill themselves with blood, and their size then becomes so much enlarged, that any one unacquainted with their habits and appearance, would scarcely recognise them.

Their motions are extremely slow and heavy, but, in compensation for this apparent defect, they are able to adhere closely and strongly even to the most solid bo-

* DESCRIPTION. The body, when filled with blood, is nearly globular. The abdomen is livid, with a round, brown spot at the base.

SYNONYMS. *Acarus ricinus*. *Linnaeus*.—*Ixode ricin*. *Latreille*.—*La Tique*. *Cuvier*.

dies. They are very tenacious of life; and their skin is so hard and tough, that they are not easily susceptible of injury. Long after they are deprived of their head, they give indications of remaining life.

In the destruction of these insects, mercurial preparations have been employed with success.

THE HARVEST-BUG *.

During the months of August and September, the Harvest-bug, in some of the southern counties of England, is a troublesome and disagreeable insect. By means of two claws situated above the upper legs, it adheres so firmly to the skin as not easily to be disengaged. Wherever it fixes it causes a tumour about the size of a pea, or larger, accompanied by a most unpleasant itching.

Harvest-bugs abound upon plants, and are generally caught from walking in gardens, among long grass, or in corn-fields. Mr. White says, they are so numerous on the chalky downs of Hampshire, that the warreners' nets are frequently discoloured, from the immense numbers that get upon them; and that the men are sometimes so bitten by them as to be thrown into fevers.

OF THE SPIDERS IN GENERAL †.

These insects, which are so remarkable, on account

* DESCRIPTION. The Harvest-bug is of a somewhat globular shape, and of a bright red colour, with the abdomen bristly behind. It is smaller than the common mite, and is but just perceptible when on the skin. *Shaw.*

SYNONYMS. *Acarus Autumnalis*. Autumnal Acarus, or Harvest-bug. *Shaw's Nat. Mis.*

† Spiders have short horny jaws, and two incurved, jointed, and sharp feelers. They are destitute of antennæ; and have eight or sometimes only six eyes, and eight legs. Their abdomen is hairy, and furnished with papillæ, from which they spin their webs.

of their industry and manners of life, are generally viewed with an aversion only to be accounted for by the displeasing impressions that are made upon us in early life. These impressions are, in general, communicated by persons ill qualified to give the mind that direction which is necessary for the purposes of life. Even many naturalists have complained that this aversion has deterred them from observing and accurately examining the habits of these insects; and those who have undertaken to do so, have generally been at much trouble to overcome their antipathy. Roesel accustomed himself to view the insects first at a distance: he then considered their webs; and, at last, he ventured to look at the insects themselves, through a microscope. Göze viewed individual parts of Spiders, till he was able to look, without any sentiment of aversion, at the entire insect. Both these naturalists so far conquered their antipathy, that they could afterwards handle and examine Spiders with perfect indifference.

Spiders prey on other insects, and do not, in all cases, spare even their own species. There is little doubt but their bite is venomous; and it is said that a fly which has once felt it can never be recovered, but soon dies in convulsions. Many of the species have been swallowed, without any subsequent inconvenience.

Some of the Spiders spin webs for the purpose of catching their prey; but others seize it by surprise. They are all able to sustain an abstinence from food for a great length of time; some for even six months, or upwards.

They frequently change their skins. The *larvæ* and *pupæ* have each eight legs, and differ in no respect from the perfect insect.

THE HOUSE-SPIDER*.

House-spiders feed principally on flies; and the web

* DESCRIPTION. The abdomen of these insects is nearly

by which they are enabled to entangle these insects is a surprising part of the animal economy. For the purpose of forming this web, they are supplied with a quantity of glutinous matter contained in a receptacle near the extremity of their bodies; and, for spinning it into thread, they have five teats, the orifices of which the insects have the power of contracting and dilating at pleasure. When they enter on the construction of this curious fabric, they fix on a spot apparently calculated both for plunder and security. The animal then distils one little drop of glutinous liquor, which is very tenacious; and creeping along the wall, and joining its thread as it proceeds, it darts itself to the opposite side, where the other end is to be fastened. The first thread thus formed, being drawn tight and fixed at each end, the Spider runs on it backward and forward, still doubling and strengthening it, as on this depends the stability of the whole. The scaffolding thus completed, it makes a number of threads parallel to the first, and then crosses them with others: the clammy substance of which they are formed serves, when first made, to bind them to each other. At the bottom of the web a kind of funnel is constructed, in which the little creature lies concealed. In this den of destruction it watches with unremitted assiduity till its prey is entangled; when this is the case it instantly darts upon its victim and deprives it of life.

The webs of Spiders differ from those woven by any human artist in this circumstance: in our work, the threads extended in length are interlaced with those that are carried on transversely; whereas, the threads of a Spider's woof only cross the threads of the warp, and are glued to them in the points where they mutually touch, and are not either inserted or interwoven.

oval, of a brown colour, and marked with five black and almost contiguous spots.

SYNONYMS. *Aranea domestica*. Linn.—L'Araignée domestique. *Tigwy*.

The threads along the border of the work are doubled or trebled, by the Spider's opening all her teats at once, and gluing several threads one over another; sensible that the extremity of the web ought to be hemmed and fortified, in order to preserve it from being torn. She likewise further secures and supports it with strong loops, or double threads, which she fixes all around it, and which hinder it from being the sport of the winds.

From time to time she finds it necessary to clear away the dust, which would otherwise incommode her web, and she sweeps the whole by giving it a shake with her paw; but in doing this she so nicely proportions the force of the blow to the strength of the work, that nothing is ever broken.

From all parts of the web are drawn several threads, which terminate, like rays in a centre, at the place of her concealment. The vibration of any of these threads is communicated to her, and gives her notice whenever there is game in the net, and accordingly she springs upon it in an instant. She derives another advantage from this retreat under her web: she there feasts on her prey in full security. It also gives her the power of concealing the carcasses, and not leaving in the purlieus any traces of her barbarity, capable of intimating the place of her retreat, and inspiring other insects with a dread of approaching it.

This Spider is furnished with a pair of sharp hooked fangs, enclosed, when at rest, in cases in the fore-part of her head. With these weapons, (which a good glass will discover to have a small slit or orifice in each point,) she seizes and pierces such insects as entangle themselves in her web; and infuses a poisonous liquid into the wound. This poison must be very deleterious; for flies, and many other insects, may be mutilated by depriving them of their legs, wings, and even cutting their bodies through the very middle of the abdomen, and in that condition they will survive several days; but this liquid in a moment kills them.

When two Spiders of the same size meet in combat,

neither of them will yield: they hold each other by their fangs so fast, that, in general, one of the two must die before they are separated. M. Leeuwenhoek says he saw one Spider that was only wounded in the leg by his antagonist. A drop of blood, as large as a grain of sand, issued from the sore; and, not being able to use this wounded leg in running away from his enemy, he held it up, and presently afterwards the limb dropped off. When Spiders are wounded in the breast or upper parts of the body, they always die.

The Spider, the Ptinus, and many insects of the beetle kind, exhibit an instinct of very extraordinary nature. When put in terror by a touch of the finger, the Spider runs off with great swiftness; but if he find that, whatever direction he takes, he is opposed by another finger, he then seems to despair of being able to escape, contracts his limbs and body, lies motionless, and counterfeits every symptom of death. "In this situation," says Mr. Smellie, "I have pierced Spiders with pins, and torn them to pieces, without their indicating the slightest marks of pain. Some beetles, when counterfeiting death, will suffer themselves to be gradually roasted, without moving a single joint."

When the House-spider changes its skin, which it does at certain seasons, an opening may be seen in the belly. Through this it draws all its limbs, and leaves the old covering hanging to the cord that sustained it during the operation.

The eyes of all the Spiders are placed on the upper part of their head, but in various positions. These have no muscles, and are therefore immovable. They also consist of only one lens each, and do not, as in other insects, possess the faculty of multiplying objects: but their number and situation enable the animals to see perfectly well in all necessary directions.

THE GARDEN-SPIDER*.

The labour of the Garden-spider, is very different from that of the former species; yet it is not performed with less art. When desirous of flitting from one place to another, this animal fixes one end of a thread to the place where she stands, and then with her hind paws, draws out several other threads from the nipples, which being lengthened, and driven by the wind to some neighbouring tree, or other object, are, by their natural clamminess, fixed to it. As soon as the spider finds that these are fastened, she makes of them a bridge, on which she can pass and repass at pleasure. This done, she renders the thread thicker, by spinning others to it. From this thread she often descends, by spinning downward to the ground. The thread formed by the latter operation she fixes to some stone, plant, or other substance. She re-ascends to the first thread, and at a little distance from the second begins a third, which she fixes in a similar manner. She now strengthens all the three threads, and, beginning at one of the corners, weaves across, and at last forms a strong and durable net, in the centre of which she places herself, with her head downward, to wait for her prey.

From its having been frequently remarked that Spiders spread their webs in solitary and confined places, to which it is sometimes difficult for flies to penetrate, M. de Vaillant concluded that these creatures must often remain long without food, and that, consequently, they were capable of enduring considerable abstinence. To ascertain the truth of this circumstance, he took a

* **DESCRIPTION.** The body of this Spider is brown and somewhat downy. On the thorax are four furrows, of which the two middle ones diverge towards the head. The abdomen, which is nearly spherical, has, from the middle to the extremity, three white lines.

SYNONYMS. *Aranea horticola.* Olivier. *Latreille.*—*L'A-raignée jardinière*, in France.

large Garden-spider, whose belly was about the size of a nut, enclosed it under a glass bell, which he secured with cement round its bottom, and left it in this situation for ten months. Notwithstanding this deprivation of food, the insect appeared during the whole time equally vigorous and alert; but its belly decreased, till at last it was scarcely larger than the head of a pin. He then put under the bell to it another Spider of the same species. For a little while they kept at a respectful distance from each other, and remained motionless; but presently the meagre one, pressed by hunger, approached and attacked the stranger. It returned several times to the charge; and, in these different conflicts, deprived the stranger of almost all its claws: these it carried away to its former situation, to devour. The meagre Spider had likewise lost three of its own claws, on which also it fed; and M. Le Vaillant perceived that, by this repast, its plumpness was in some degree restored. On the following day, the new comer, deprived of all its means of defence, fell a complete sacrifice. It was speedily devoured; and in less than twenty-four hours, the old inhabitant of the bell became as plump as it was at the first moment of its confinement.

From the bags in which the offspring of the Garden-spider are produced, an attempt has been made to manufacture a kind of silk. With some trouble, thirteen ounces of these bags were collected. They were for some time beaten with a stick, to free them from dust, and then washed in warm water till they were perfectly clean. After this they were steeped in a pot with soap, nitre, and gum arabic, and then boiled in the same mixture over a gentle fire for two or three hours. Clean warm water was again used to free them from the soap, &c.; and, after having been laid for some days to dry, they were loosened with the fingers, previously to being carded by the common silk-carders. A beautiful ash-coloured silk was thus obtained, easy to be spun, and much stronger in the thread than that of the silkworm.

This was woven in a stocking-weaver's loom, and there can be no doubt but it would bear any other loom. The thirteen ounces of bags yielded nearly four ounces of silk, three of which made a pair of stockings large enough for a man. It would be difficult to obtain bags sufficient to render the manufacture of this kind of silk important in a commercial view; as, to obtain one pound of silk, no fewer than 28,000 bags would be wanted; and for this quantity a greater number of spiders than this must be bred, as none but the females spin them. But a still greater difficulty arises from the carnivorous disposition of the insects, which leads them to devour each other. Were not this the case, a very nutritious food might be adopted for them, in the soft substance of fresh quills. If the silk had answered, we should have had, from different species of Spiders, several genuine colours in silk; such as gray, white, sky-blue, and coffee-colour; whereas, silkworms yield only white and orange-colour.

These Spiders lay six or seven hundred eggs in the same bag. This is generally done in August or September, and about sixteen days afterward the young-ones are hatched. If the weather continue cold, these remain in their nidus for several months, without eating or increasing in bulk; but they make their appearance abroad at the commencement of the warm weather. The old ones live only a short time after the eggs are laid.

THE WANDERING SPIDER*, AND JUMPING SPIDER.

The Wandering Spider, which is very common on

* DESCRIPTION. The colour of the Wandering Spider is reddish brown, darker on the thorax than the abdomen. This part has, on each side, towards the top, a blackish line, or a brown spot. The two anterior legs, which are long, have blackish rings. The four hind legs are very short.

SYNONYMS. *Aranea viatica*. Linn.—*L'Araignée rurale*. Latreille.

plants, does not lie in wait for its prey, like several others: it is a lively and active hunter. Its head is furnished, as in the rest, with immovable eyes. Without any motion of the head, it perceives all the flies that hover around: it does not alarm, but stretches over them its arms, furnished with feathers, which prove nets that entangle their wings. The Spider seizes them between its merciless claws, and instantly sucks their blood.

In its general form, as well as in its manner of running, the Wandering Spider has much the appearance of a small crab. It carries its eggs enveloped in a small bag of whitish silk.

The manners of the *Jumping Spider** are very singular. This insect does not, like many others, take its prey by means of a net, but it is constrained to seize them only by its own activity. It is extremely nimble, at times leaping like a grasshopper, then standing still, and raising itself on its hind legs to look around for prey. If it see a fly at the distance of three or four yards, it does not run directly to it, but endeavours, as much as possible, to conceal itself till it can arrive near; and then creeping slowly up, and seldom missing its aim, it springs upon the insect's back, in which case it is almost impossible for the fly to effect an escape. But if, before the Spider reach it, the fly take wing and fix upon another place, the little animal whirls nimbly about, and still keeps its eye upon it, in order to commence a fresh attack.

* **DESCRIPTION.** The abdomen is oblong, and has three semicircular white lines on each side. The body is covered with silvery hair. The legs are short, hairy, black, and white.

SYNONYMS. *Aranea scenica.* Linn.—*L'Araignée Chevronnée*, in France.

THE WATER-SPIDER *.

This singular little creature is a very common inhabitant of our fresh waters. When in the water, its belly appears as if covered with a silver varnish. This, however, is nothing more than a bubble of air, attached to the abdomen by the oily humours which transpire from the body, and prevent the immediate contact of the water. By means of this kind of bubble, the insect forms its dwelling under the water. It fixes several silky threads to the stalks of water-plants, and then, ascending to the surface, thrusts the hinder part of its body above the water, drawing it back with so much rapidity, as to attach beneath a bubble of air, which it has the art of detaining below, by placing it under the threads above-mentioned, and which it bends, like a covering, almost round it. It then again ascends for another air-bubble, and thus proceeds till it has constructed an aerial apartment under the water, which it enters into or quits at pleasure. The male constructs for himself one near that of the female, and afterwards breaks through the thread walls of the female's dwelling; and the two bubbles, attached to the bellies of both, unite into one, forming one large chamber.

The female takes care of the young-ones, and constructs similar apartments for them.

The figure of this Spider has in it nothing remarkable; and the insect may be overlooked among a crowd of curiosities, if the spectator be unacquainted with its singular art of constructing an aerial habitation under

* DESCRIPTION. The Water-spider is of a brown colour, and somewhat downy. The male is much larger than the female. In both sexes the two anterior legs are much longer than the others, and the nippers are very large. On the abdomen there are many transverse wrinkles; and on the back there are two impressed dots.

SYNONYMS. *Aranea aquatica*. Linn.—*L'Araignée aquatique*. Tigny.

water, and thus availing itself of the properties of both elements. It lodges, during the winter, in empty shells, which it dexterously closes with a web.

THE GOSSAMER SPIDER*.

The following observations, by M. Bechstein, a German naturalist, on the origin of the Gossamer, are curious, and convey a more accurate account of it than I have met with in any other writer :

“Some naturalists (says this gentleman) have considered the Gossamer as the evaporation of plants, condensed by the air during the cool days of harvest, and converted into threads like those which can be drawn from resinous juices ; others, as the production of a kind of spider, on account of its similarity to the threads of common spiders : and M. Pereboon has discovered a kind of beetle, furnished with a vesicle on its back ; from the hinder parts of which, on both sides, proceed two threads, that extend over the extremity of the body, and end in a double thread, sometimes ten or more inches in length : this thread he supposes to form the Gossamer.

“Having, for many years, made the closest observations on this phenomenon, I am of opinion it is caused by a species of field-spider, so small and active, as to be imperceptible, unless the observer possess a very acute sight. This spider, if it have no name already, I propose to call the Gossamer Spider, *Aranea Obtextrix*. It is about the size of the head of a small pin. Its head is somewhat long, and has in the fore-part eight gray eyes, placed in a circular form. The body is of a shining dark brown colour, with the abdomen shaped like an egg. The legs are yellowish.

“These spiders first appear in the beginning of October, in woods, gardens, and meadows, where their

* *Aranea Obtextrix*?

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SYNONYMS. *Aranea aquatica*. Linn.—*L'Araignée aquatique*. Tigny.

"The Gossamer Spiders appear in swarms only during the harvest ; but single spiders are to be found through the whole summer."

We have a very curious account of the Gossamer, inserted by Mr. White, in the Natural History of Selborne. "On September the 21st, 1741, being intent on field diversions, I rose before day-break. When I came into the enclosures, I found the stubbles and clover-grounds matted all over with a thick coat of cobweb, in the meshes of which a copious and heavy dew hung so plentifully, that the whole face of the country seemed, as it were, covered with two or three setting-nets drawn one over another. When the dogs attempted to hunt, their eyes were so blinded and hood-winked that they could not proceed, but were compelled to lie down and scrape the incumbances from their faces with their fore-feet ; so that, finding my sport interrupted, I returned home, musing in my mind on the oddness of the occurrence.

As the morning advanced, the sun became bright and warm, and the day proved one of those most lovely ones, which no season but the autumn produces, cloudless, calm, serene, and worthy of the south of France itself.

"About nine, an appearance very unusual began to demand our attention ; a shower of cobwebs fell from very elevated regions, and continued without interruption, till the close of the day. These webs were not single filmy threads, floating in the air in all directions, but perfect flakes or rags ; some nearly an inch broad, and five or six inches long, which fell with a degree of velocity, that showed they were considerably heavier than the atmosphere.

"On every side, as the observer turned his eyes, he might behold a continual succession of fresh flakes falling within his sight, and twinkling like stars, as they turned their sides toward the sun.

"How far this wonderful shower extended it would be difficult to say ; but we know that it reached *Bradley*, *Selborne*, and *Alresford*, three places which lie in a sort

of triangle, the shortest of whose sides is about eight miles in extent.

"At the second of these places a gentleman of my acquaintance observed it the moment he got abroad; but he concluded that, as soon as he came upon the hill above his house, where he took his morning rides, he should be higher than this meteor; which, he imagined, might have been blown, like *thistle-down*, from the common above. But, to his great astonishment, when he rode to the most elevated part of the down, 300 feet above the level of his fields, he found the webs, in appearance, as much above him as before; still descending into sight in a constant succession, and twinkling in the sun, so as to draw the attention of the most incurious observer.

"Neither before nor after this was any such fall observed; but on this day the flakes hung on the trees and hedges, so thick, that a diligent person sent out might have gathered baskets full.

"The remark that I shall make on these cobweb-like appearances, called *Gossamer*, is, that, strange and superstitious as the notions about them were formerly, nobody in these days doubts but they are the real production of small spiders, which swarm in the fields in fine weather in autumn, and have a power of shooting out webs from their tails, so as to render themselves buoyant, and lighter than air. But why these apterous insects should *that day* have taken such a wonderful aerial excursion, and why their webs should at once have become so gross and material as to be considerably more weighty than air, and to descend with precipitation, is a matter beyond my skill to decide. If I might be allowed to hazard a supposition, I should imagine, that those filmy threads, when first shot, might be entangled in the rising dew, and so drawn up, spiders and all, by a brisk evaporation, into the regions where clouds are formed; and if the spiders have a power of coiling and thickening their webs in the air, as Dr. Lister says they have,

then, when they become heavier than the air, they must fall.

"Every day in fine weather, during autumn chiefly, do I see these spiders shooting out their webs and mounting aloft: they will go off from your finger, if you take them into your hand. Last summer one alighted on my book, as I was reading in the parlour; and, running to the top of a page, and shooting out a web, it took its departure thence. But what I most wondered at was, that it went off with considerable velocity, in a place where no air was stirring; and I am sure I did not assist it with my breath. So that these little crawlers seem to have, while mounting, some locomotive power without the use of wings, and to move in the air faster than the air itself.

THE TARANTULA*.

The Tarantula Spider is a native of Italy, Cyprus, Barbary, and the East Indies. This animal lives in fields, and its dwelling is in the ground, about four inches deep, half an inch wide, and closed at the mouth with a net. These spiders do not live quite a year. They lay about 730 eggs, which are hatched in the spring. The parents never survive the winter.

Inflammation, difficulty of breathing, and sickness, are said to be the invariable consequences of the bite of this insect. Dr. Mead, and other medical men, have countenanced the absurd story of these effects being counteracted by the power of music. It is, however, known, that this singular mode of cure was nothing more than a trick practised on credulous travellers, who

* DESCRIPTION. This spider is somewhat more than an inch in length. The breast and belly are of an ash-colour. The legs are likewise ash-coloured, with blackish rings on the under part. The fangs are red within.

SYNONYMS. *Aranea Tarentula*. *Linnaeus*.—L'Araignée Tarentule.

were desirous of witnessing it. Mr. Swinburne, when he was in Italy, minutely investigated every particular relative to this insect. The season was not sufficiently far advanced, and it was pretended that no persons had that year been yet bitten: he, however, prevailed upon a woman, who had formerly been bitten, to perform the dance before him. Several musicians were summoned, and she performed it, as every one present assured him, to admiration. At first she lolled stupidly on a chair, while the instruments played a dull strain. They touched at length the chord supposed to vibrate to her heart; and up she sprang with a hideous yell, staggered about the room like a drunken person, holding a handkerchief in both hands, raising her hands alternately, and moving in true time. As the music grew brisker, her motions quickened, and she skipped about with great vigour, and in a variety of steps, every now and then shrieking very loud. The scene was unpleasant, and, at his request, the dance was terminated before the woman was tired.

Mr. Swinburne informs us, that, wherever the dance is to be performed, a place is prepared for the dancers, hung round with ribbons and bunches of grapes. The patients are dressed in white, with red, green, or yellow ribbons: on their shoulders they have a white scarf; they let their hair fall loose about their ears, and throw the head quite back. He says, that they are exact copies of the ancient priestesses of Bacchus. The introduction of Christianity abolished all public exhibitions of heathenish rites; but the women, unwilling to give up their darling amusement, in performing the frantic character of Bacchantes, devised other pretences; and he supposes that accident led them to the discovery of the Tarantula, on the strength of whose poison the Puglian dames still enjoy their old dance, though time has effaced the memory of its ancient name and institution.

THE BIRD-CATCHING SPIDER*.

If the spiders that are found in Europe are contemplated with aversion and alarm, by those who are in the habit of constantly seeing them, surely this American species, whose gigantic size and great muscular power, render it a terror even to the feathered tribes, cannot be beholden without extraordinary sensations of horror.

The legs of this enormous creature extend over a space of nearly ten inches. From the head to the extremity of the abdomen, it often measures more than three inches. The legs are as thick as a goose's quill, and closely covered with hair. The body is brown, and the fangs are as strong and sharp as in some of the rapacious species of birds. It is not uncommon in many parts of America, but is principally found in the southern division of that continent, and particularly in Guiana.

Captain Stedman, while residing at Surinam, had one of these insects given to him. He put it into a case-bottle eight inches high; and, when this was filled with spirits, the animal reached the surface with some of its claws, while others rested on the bottom. On the whole, he says, these spiders are so hideous, that the very sight of them is sufficient to occasion a tremor of abhorrence, even in persons most accustomed to view them.

This spider resides in trees, and frequently seizes on small birds, which it destroys by sucking their blood, after having first wounded them by its fangs, which distil a poisonous liquid into the wound. The slit or orifice near the tip of the fangs, through which the poison is emitted, is so visible, as to be distinctly perceptible even without a glass.

The eight eyes of this terrible insect are placed in front of the thorax, somewhat in the form of an oblong

* SYNONYMS. *Aranea avicularia*, *Linnaeus*.—*L'Araignée aviculaire*. *Tigny*.

square. Of these, the two middle ones are so large, as to be capable of being set in the manner of glasses, and used as microscopes: the rest are smaller, and of an oval shape. The thorax is orbicular, and has a transverse central excavation.

In Jamaica there is a kind of spider*, the female of which digs a hole in the earth obliquely downward, about three inches in length, and one inch in diameter; this cavity she lines with a tough, thick web, which, when taken out, resembles a leathern purse; but what is most curious, this house has a door with hinges, like the operculum of some sea-shells; and herself and family, who tenant this nest, open and shut the door whenever they pass or repass.

In some places in the forests of Java, the webs of spiders have been found, woven with threads of so strong a texture, as not easily to be divided without a knife.

Dampier informs us, that at Campeachy, in New Spain, there "is a sort of spiders of prodigious size, some nearly as big as a man's fist, with long and slender legs, like the spiders in England. They have two fangs, each an inch and a half long, and of a proportionable thickness, which are black as jet, smooth as glass, and at their small end as sharp as a thorn: these are not straight, but bending. Some persons wear them in their tobacco-pouches, to pick their pipes with; others preserve them for tooth-picks, especially such as are troubled with the tooth-ache; for, if report may be trusted, they will expel that pain. The backs of these spiders are covered with a dark yellowish down, as soft as velvet. Some say they are venomous, and others that they are not; but which of these accounts is to be credited I cannot determine."

* *Aranea nidulans.* Linn. Gmel.

OF THE SCORPION TRIBE*.

Scorpions may be considered as the most malignant and poisonous of all known insects. Their poison is emitted through three very small holes in the sting, one on each side of the tip, and the other on the upper part. In California there is a species, the *Scorpio Americanus*, which is eaten by the inhabitants.

These animals prey on worms and insects, and frequently even on one another. Their offspring are produced from eggs, of which one female lays a considerable number. After their appearance, they seem to undergo no further change than perhaps casting their skin from time to time, in the same manner as spiders.

THE COMMON SCORPION†.

In some parts of Italy and France these animals are among the greatest pests that can plague mankind; but in those countries of the East, where they grow to a foot in length, there is no removing a piece of furniture, with-

* The Scorpions have each eight legs, besides two claws, not unlike those of a crab. They have also eight eyes, three of which are placed on each side of the thorax, and two in the middle. On the anterior part of the head they have two short claw-like feelers; but no antennæ. And on the under side, between the breast and the abdomen, are two instruments, that have some resemblance to a comb. The tail is long, jointed, and terminated by a sharp, crooked sting, from which is emitted a pungent liquid, not dangerous, except in the very hot climates.

† See Plate xix. Fig. 12.

DESCRIPTION. This, like other Scorpions, has a distant resemblance in shape to the lobster, but it is infinitely more ugly. The head appears, as it were, jointed to the breast; and the mouth is furnished with two jaws; the under one of which is divided into two, and the parts, notched into each other, answer the purpose of teeth in breaking the food. On each side of the head there is a four-jointed arm, terminated by a claw, somewhat like that of a lobster. The belly is divided into seven segments, from the lowest of which the tail commences: this,

out danger of being stung by them. There, we are told, they are nearly as large as small lobsters.

Many experiments have been made to ascertain the strength of their poison; and, in warm climates, it has uniformly been found fatal to small animals. To man the wound is extremely painful. The place becomes inflamed, and the surrounding parts often turn livid, and require to be carefully dressed in order to prevent mortification.

We are informed, that when a Scorpion is surrounded by burning coals or wood, so as not to be able to escape, it will strike its sting into its own body and destroy itself: but this seems merely a legend, undeserving of belief.

M. Navarette says, that, when he was in the Philippine islands, he was instructed in an infallible preservative against the sting of Scorpions. The reader will smile, when he is told that this consisted only in making a commemoration of St. George, every night when he went to bed. "I continued," says he, "this devotion many years; and, God be praised, the saint always delivered me, both there, and in other countries, from those and such like insects." He, however, afterwards observes, that he used another preventive, that of rubbing his bed all round with garlic, to keep the Scorpions at a distance."

This creature, which is but too common about old houses, and in dry or decayed walls, in all hot countries, is extremely bold and watchful. At the approach of an enemy, it seldom exhibits any signs of fear, but with its tail erect, and sting in readiness, as if fully confident in the force of its poison, it waits the attack with courage and intrepidity, and seldom desists till either it is itself killed or its foe is put to flight.

in the present species, is armed with a hard, pointed, and crooked sting, the poison of which is very powerful.

SYNONYMS. *Scorpio Afer*. *Lin.*—*Le Scorpion d'Afrique*. *Tigny*.

OF THE CRAB TRIBE*.

These animals live chiefly in the sea; some, however, inhabit the fresh waters, and a few live on land. They feed variously, on aquatic or marine plants, small fish, molluscæ, or dead bodies. The females carry their ova under their tail, which, for that purpose, is, in general, much broader than that of the males.

The animals emphatically denominated *Crabs*, have a short, flat tail, bent close to the body in a hollow betwixt the legs. The *Hermit-crabs* have a soft tail, without any crustaceous covering: this they fit into empty shells, or hollow stones. In the *Lobsters* the tail is the principal part of the body, being a very strong member, and employed with great advantage both in swimming and leaping. This is formed of six convex segments, which lie over each other, somewhat like the tiles of a house, and are terminated by five laminæ, or thin plates. The former are united by loose membranes, which admit of much motion. At the angle where the upper and lower parts join, these segments are furnished with a kind of crustaceous fins, bordered with hair, and consisting of several articulations, called by naturalists *pedes natatorii*. The fins are moved, backward and forward, and a little outward and inward, by small muscles, contained within each articulation. By means of these it is that the animals have their progressive motion at different depths in the water.

Most of the Crabs have eight legs, (a few, however, have six or ten,) besides two large claws, which serve the purposes of hands. They have two eyes, situated on tubercles projecting from the head, and moveable in any direction. When the extremities of these are viewed with a glass, they are found to be composed of a multi-

* All the animals of this tribe have their bodies covered with a hard and strong shell. The head is united to the thorax or breast without any joint.

tude of lenses, like the eyes of insects. For a sense of touch, these animals are furnished with antennæ, and palpi, or feelers. They have likewise a heart, with arterial and venous vessels, and branchiæ or gills for respiration. Their jaws are transverse, strong, and numerous; and the stomach is furnished with internal teeth.

THE LAND-CRAB*.

Land-crabs are natives of the Bahamas, and of most of the other islands between the tropics. They live in the clefts of rocks, the hollows of trees, or in holes which they dig for themselves in the mountains. About the months of April and May in every year, they descend in a body of some millions at a time, to the sea-coast, to deposit their spawn, and at this season the whole ground seems alive with them. They march in a direct line to their place of destination, and are said seldom to turn out of their way on account of intervening obstacles. Even if they encounter a lofty wall, or a house, they will attempt to scale it. If they arrive at a river, they wind along the course of the stream.

They are as regular in their procession as an army under the direction of an experienced commander, being generally divided into three battalions. The first of these consists of the strongest males, which march forward to clear the route and face the greatest dangers. The main body is composed of females, which are sometimes formed into columns fifty or sixty yards broad,

* DESCRIPTION. The largest of these animals measure about six inches across the body. They vary in colour, but are commonly of a blackish violet colour: some are entirely black, others yellow or red, and others variegated. They are distinguished from other species of Crabs by having the first joint of the legs spinous, and the second and third furnished with tufts of hair.

SYNONYMS. Cancer Ruricola. Linn.—Violet Crab.—Ocy-pode Ruricule. Ocipoda Ruricola. Latreille.

and three miles deep. The first division is often obliged to halt from want of rain, and the females never come from the mountains until the rains have set in for some time. Three or four days after these, the rear-guard follows; a straggling, undisciplined tribe, consisting of males and females, but neither so robust nor so vigorous as the former.

They proceed chiefly in the night; but if it rain during the day, they always profit by it. When the sun is hot, they invariably halt till the evening. When terrified, they run in a confused and disorderly manner, holding up and clattering their nippers, with a threatening attitude; and if they be suffered to catch hold of the hand, they will sometimes tear off a piece of the skin. If, in their journey, any one of their body be so maimed as to be incapable of proceeding, some of the others always fall upon and devour it. They march very slowly, being sometimes three months or upward in gaining the shore.

When arrived at the coast, they prepare to cast their spawn: for this purpose they go to the edge of the water, and suffer the waves to wash twice or thrice over their bodies. They then withdraw, in order to seek a lodging upon land. In the mean time the spawn is extruded in a bunch from the body, and adheres to the under parts of the tail. This bunch becomes as large as a hen's egg, and exactly resembles the roe of a herring. In this state they again, for the last time, seek the shore, and shaking off the spawn into the water, leave it to the heat of the sun, to be brought to maturity. About two-thirds of the eggs are devoured, by the fish which annually frequent the shores in expectation of this prey. Those that escape are hatched under the sand; and, not long after this, millions of the little Crabs may be seen quitting the shore, and slowly travelling towards the mountains.

The old ones, in their return, are feeble, lean, and so inactive, that they are scarcely able to crawl along; and their flesh at this time changes its colour. Many of

them are obliged to continue in the level parts of the country till they recover, making holes in the earth, which they block up with leaves and dirt. In these they cast their old shells, and continue nearly motionless for six or seven days, when they become so fat as to be delicious food. After this they march slowly back to the mountains.

They subsist on vegetables, and, except when impelled by the desire of bringing forth their young, seldom venture out from their mountainous retreats. At this season the inhabitants of the islands where they are found, wait in eager expectation for their descent, and destroy thousands of them; they disregard the bodies, and take only the spawn that lies on each side of the stomach within the shell, about the thickness of a man's thumb. The animals are much more valuable as food on their return, after they have cast their shells. They are taken in the holes; and, when on their journey, are also sought for by night, by the light of flambeaux. The instant the Crabs perceive themselves attacked, they throw themselves on their back, and, with their claws, pinch most dreadfully whatever they happen to fasten on. But the crab-catcher seizes them by the hind legs, in such manner that the nippers cannot touch him. They are caught in their holes by the sea-side, by so fixing a stick as to prevent their escaping; and soon afterward the tide enters the holes, and the animals are drowned. Wafer says, that the inhabitants of some of the Caribbee islands, when they have caught these Crabs, put them for three or four days into a piece of potatoe-ground, in order to render their flesh more firm, and better eating.

THE COMMON OR BLACK-CLAWED CRAB.

The most remarkable circumstance in the history of

* SYNONYMS. *Cancer pagurus*. Linn.—Eatable Crab.—*Crabé paguré*. Latreille.

these animals, is the changing of their shells and broken claws. The former, as it is stated, is done once a year, and usually between Christmas and Easter. During the operation they retire among the cavities of rocks and under great stones; and Dr. Darwin (from the authority of a friend who had been engaged in surveying the sea-coasts) says, that a hard-shelled Crab always stands sentinel, to prevent the sea-insects from injuring the rest in their defenceless state; and that, from his appearance, the fishermen know where to find the soft ones, which they use for baits in catching fish; adding that, though the hard-shelled Crab, when he is on duty, advances boldly to meet the foe, and will with difficulty quit the field, yet at other times he shows great timidity, and is very expeditious in effecting his escape: if, however, he be often interrupted, he will, like the spider, pretend to be dead, and will watch an opportunity to sink himself into the sand, keeping only his eyes above.

In the under part of the shell of these Crabs a crescent-formed suture may be observed, which opens at the casting of the shell, and leaves a space sufficient for drawing out the whole body. The thorax soon afterwards drops its breast-plate, and then the legs quit their crustaceous covering. The body is now only enveloped in a soft skin, not unlike wet parchment; and the animal is so helpless as, for a while, to be incapable of motion; but lies between the rocks until he has acquired sufficient strength and hardness to bear the weight of his body, and convey himself from place to place, for the purpose of performing his usual functions. The old shell is left in two divisions, one that covered the body, and the other that enclosed the legs. Dr. Darwin asserts, that the stomach and intestines are also cast with the skin; and that the first food the animal takes, after recovering his strength, is the old stomach. It sometimes happens that the shell hardens prematurely, and fixes the animal a prisoner in his crevice: for fishermen have often found Crabs thus immured. When these

animals are out of health, they do not change their shells regularly, the old shells always remaining till they have recovered their proper strength and vigour.

When the fishermen take a Crab that is not in good condition, they return it into the sea, and sometimes mark it on the back with the end of a knife or some other sharp-pointed instrument; and it is very surprising that this mark may not only be seen to remain on the old shell, but that it is also found impressed on the subsequent new one. These men also say, that, when Crabs have had their shells marked, and have been carried out to the distance of two or three miles, and thrown among others, they will always find their way back again.

When the claw of a Crab is bruised, it bleeds, and the animal seems, by its motions, to experience much pain. For a while it moves it from side to side; then, holding it perfectly steady in a direct position, the claw on a sudden gives a gentle crack, and the wounded part drops off; not at the joint, as might be imagined, but in the smoothest part of the limb: "just (says Mr. Collinson) as one sees the neck of a retort separate, when it has been heated by a red-hot iron ring, on the application of cold water." If, however, the wound happen to be at the extremity of the claw, the animal is said generally to bleed to death, or to pine away, in consequence of the slow and almost insensible leaking of the vital moisture.

Crabs are naturally quarrelsome, and frequently have serious contests, by means of those formidable weapons, their great claws. With these they lay hold of their adversary's legs; and wherever they seize, it is not easy to make them forego their hold. The animal seized has, therefore, no alternative but to leave part of the leg behind in token of victory.

Mr. Collinson was shown an experiment, to prove the extremely tenacious disposition of the Crab. A fisherman, by irritation, made a Crab seize one of its own small claws with a large one. The animal did not dis-

tinguish that it was itself the aggressor, but exerted its strength, and soon cracked the shell of the small claw. Feeling itself wounded, it cast off the piece in the usual place, but continued to hold with the great claw for a long time afterward.

Fishermen say that Crabs will live confined in a pot or basket for several months, without any other food than what is collected from the sea-water, and that even in this situation they will not decrease in weight.

This species of Crab is found on the rocky coasts both of Europe and India; and is almost the only species that is eaten in England.

THE HERMIT CRAB*.

Having no shell to any part but its nippers, the Hermit Crab supplies by art what is denied to it by nature: for, taking possession of the deserted shell of some other animal, it occupies that, till, by becoming too large for its habitation, it is under the necessity of changing it.

It is curious enough, in some countries, to observe this animal busily parading the sea-shore, along that line of pebbles and shells, which is formed by the furthest wave; still, however, dragging its old inconvenient habitation at its tail, unwilling to part with one shell, even though a troublesome appendage, till it can meet with another more convenient. It stops first at one shell, turns it, passes by; then goes to another, contemplates that for a while, and, slipping its tail from the

* DESCRIPTION. The Hermit Crab is usually about four inches long. It has no shell behind, but is covered as far as the tail with a rough skin, terminating in a point. It is armed with two strong and hard nippers before, one of which is as thick as a man's thumb, and so strong as to be capable of inflicting a very severe wound.

SYNONYMS. Cancer Bernhardus. Linn.—Pagure Bernard. Latreille.—Pagurus Bernhardus. Fabricius.

old habitation, tries on the new one. If this be found inconvenient, it quickly resumes the old one. It thus frequently changes, till at length it finds one that is light, roomy, and commodious. To this it adheres, though the shell be sometimes so large as to hide both the body and claws of the animal.

But many trials and many combats are sometimes to be sustained by the Hermit Crab, before he is thus equipped: for there is often a contest between two of these animals for some favourite shell. They both endeavour to take possession. They strike with their claws, and bite each other, till the weakest is compelled to yield. The victor then takes possession, and, in his new acquisition, parades backward and forward on the strand, before his envious antagonist. These Crabs feed on small marine animals of various kinds.

THE LOBSTER*.

Lobsters are found on most of the rocky coasts of Great Britain. Some are caught with the hand, but the greater number in *pots*; a sort of traps, formed of twigs, and baited with garbage. These are formed like a wire mouse-trap, so that when the lobster gets in, there is no return. They are fastened to a cord sunk into the sea, and their place is marked by a buoy.

These animals are extremely prolific. Dr. Baster says he counted 12,444 eggs under the tail of a female Lobster, besides those that remained in the body unprotruded. They deposit these eggs in the sand, where they are soon hatched.

Like the rest of their tribe, they are said annually to cast their shells. Previously to putting off their old shell, they appear sick, languid, and restless. They acquire an entirely new covering in a few days; but

* SYNONYMS. *Cancer gammarus*. Linn.—*Astacus marinus*. Fabricius.—*Ecrevisse homard*, in France.

during the time that they remain defenceless, they seek some lonely place, lest they should be attacked and devoured by such of their brethren as are not in the same weak condition.

At the same time that they cast their shell, they change also their stomach and intestines. The animal, while it is moulting, is said to feed upon its former stomach, which wastes by degrees, and is at length replaced by a new one.

Like some of the Crabs, these animals are said to be attached to particular parts of the sea.

The pincers of one of the Lobster's large claws are furnished with knobs, and those of the other are always serrated. With the former it keeps firm hold of the stalks of submarine plants, and with the latter it cuts and minces its food very dexterously. The knobbed or numb claw, as the fishermen call it, is sometimes on the right, and sometimes on the left side, indifferently. It is more dangerous for a person to be seized by the cutting claw than the other; but, in either case, the quickest way of getting disengaged from the creature, is to pluck off its claw.

In casting their shells, it is difficult to imagine how the Lobsters are able to draw the flesh of their large claws out, leaving the shells of these entire and attached to the shell of the body; in which state they are constantly found. The fishermen say, that, previously to this operation, the Lobster pines away, till the flesh in its large claw is no thicker than the quill of a goose, by which they are enabled to draw this through the joints and narrow passages near the trunk. The new shell is membranaceous at first, but it hardens by degrees. Lobsters only grow in size while their shells are in a soft state.

In the water these animals are able to run nimbly upon their legs or small claws; and, if alarmed, they can spring, tail foremost, to a surprising distance, almost as swiftly as a bird can fly. The fishermen can see them pass about thirty feet, and, by the swiftness of

their motion, it is supposed that they may go much further. When frightened, they will spring from a considerable distance to their hold in the rock; and, what is not less surprising than true, will throw themselves into their hold in that manner, through an entrance scarcely sufficient for their bodies to pass; as is frequently seen by the people who catch Lobsters at Filey Bridge, near Scarborough.

The circumstance of Lobsters losing their claws at thunder-claps, or the sound of cannon, is well-authenticated; and the fishermen are often jestingly threatened with a salute by the sailors. The restoration of claws thus lost may always be observed; for these never again grow to their former size. When the claws of Lobsters become inconvenient to the animals, from being injured, they always break them off.

Lobsters are caught in such abundance on the coast of Northumberland, that, about the year 1769, the sum paid for the annual exports from Newbiggen and Newton, by the sea, amounted to nearly 1500*l*. This circumstance was stated by John Creswell, Esq. of Creswell, who, for many years, had made the payments for them from one fishmonger in London, on whose account all the most valuable fish from the coast of Northumberland were shipped.

THE PRAWN*, AND SHRIMP†.

Prawns are chiefly found among sea-weed, and in the vicinity of rocks at a little distance from the shore.

* **DESCRIPTION.** The Prawn has a long horn in front of its head, compressed vertically, serrated both above and below, and bending somewhat upward. The thorax is smooth; the claws are small; and the intermediate antennæ on each side are treble.

SYNONYMS. Cancer Squilla. *Linnaeus*.—La Crevette ou Salicoque. *Cuvier*.—Palsemon Squille. *Tigny*. *Latreille*.—Pandle, in some parts of England.

† **DESCRIPTION.** The Shrimp is considerably smaller than

They seldom enter the mouths of rivers. Their usual mode of swimming is on their backs; but when threatened with danger, they throw themselves on one side, and spring backward to very considerable distances. They feed on all the smaller kinds of marine animals, which they seize and devour with great voracity. In their turn, they are the prey of numerous species of fish; although the sharp and serrated horn in front of their head constitutes a very powerful weapon of defence against the attacks of all the smaller kinds.

Being in great request for the table, they are eagerly sought for by fishermen, who catch them either in osier baskets, similar to those employed in catching lobsters, or in a kind of nets, called *putting-nets*. These, which are well known to all frequenters of the sea-coasts, are five or six feet in width, and flat at the bottom; and are pushed along in the shallow water, upon the sandy shores, by a man who walks behind. When fresh, the colour of the Prawn is somewhat cinereous; but, when boiled, it changes to a beautiful light red.

At the side of the head there is frequently to be observed a large and apparently unnatural lump. This, if examined, will be found to contain, under the thoracic plate, a species of crustaceous animal, which occupies the whole cavity, and there feeds, and perfects its growth. It is described very minutely by Col. Montague, in the Linnean Transactions, and is denominated by him *Oniscus Squillarum*. This gentleman says respecting it, "The most incurious person cannot but have noticed the tumour so common on the thorax of the Prawn or Shrimp, during the summer months, that is occasioned by the lodgment of this animal, whose

the Prawn. In place of the horn above-mentioned, it has two thin, projecting laminae. The claws have a single, hooked, movable fang. The intermediate antennae on each side are only double.

SYNONYMS. Cancer Crangon. Linn.—Le Cardon. Cuvier.
—Crangon vulgaire. Tigny. Latreille.

growth occasions the distortion of the shell. This tumour forms a secure asylum for the production of the more than usually soft and membranaceous bodies of the parasitical *Onisci*.

"That an insect so extremely common, and so obvious to even the most cursory observer, should not have found a place in the *Systema Naturæ* of Linnæus, appears very extraordinary. The male, which has hitherto escaped observation, is probably very minute."

The *Shrimp* is much smaller than the Prawn, and is by no means so much esteemed for the table as this. It frequents sandy sea-shores in great abundance, and not unfrequently enters harbours, and even the ditches and ponds of salt-marshes. Its habits and economy are, in most respects, similar to those of the Prawn.

THE COMMON OR FRESH-WATER CRAW-FISH*.

When the claw of the common Craw-fish is broken, it has been observed that, a day or two after the piece is cast off, a red membrane, not unlike a bit of red cloth, closes the aperture. This is at first plain; but, in four or five days, it assumes a convexity, which gradually augments until it takes the appearance of a small cone, about a line in height. It continues, however, to stretch out, and in ten days is sometimes more than three lines, or about a quarter of an inch high. It is not hollow, but filled with flesh, and this flesh is the basis or rudiment of a new claw. The membrane that covers the flesh performs the same office to the young claw as the membranes do to the foetus of the larger animals. It extends in proportion as the animal grows; and, as it is tolerably thick, we can perceive nothing but a lengthened cone. When fifteen days are elapsed, this cone inclines towards the head of the animal. In a few days more its curvature increases, and it begins to assume

* SYNONYMS. *Cancer astacus*. Linn.—*Astacus fluviatilis*. Fabricius.—*Ecrevisse de rivière*, in France.

the appearance of a dead claw. But, though at the end of a month or five weeks this claw has acquired the length of more than half an inch, it is still incapable of action. The membrane in which it is enclosed, becoming gradually thinner in proportion as it extends, gives an opportunity of observing the parts of the claw, and we now perceive that this conical substance is not a simple congeries of flesh. The moment is now arrived when the claw begins to be brought forth. The membrane bursts, and the new claw, though still soft, appears without incumbrance or investment. In a few days more it is covered with a shell; and, though still delicate, and not the half its former length, the animal is able to perform with it all the natural functions. A similar reproduction takes place also in the horns; but, if the tail be cut off, the animal survives only a few days.

Craw-fish are found in many of our rivers, lodged in holes which they form in the clayey banks; and their presence is generally esteemed an evidence of the goodness of the water. They are frequently caught by sticks split at the end, with a bait inserted in the cleft, and stuck in the mud at the distance of a few feet from each other. These sticks, after remaining some time, are taken up, and generally with an animal adhering to each. They are gently drawn out of the mud, and a basket is put under them to receive the animals, which always drop off when brought to the surface of the water.

OF THE SCOLOPENDRÆ, OR CENTIPEDES, IN GENERAL.

Centipedes live chiefly on insects, and inhabit decayed wood, or hollows under stones. Those that frequent hot climates are large, and many of them are very venomous.

All the species have tapering antennæ, and two thread-shaped feelers united between the jaws. The





Edwards del. et sculp.

1, 2. Cockchafer & Grub. 3. Burying Beetle. 4. Orator Mantis. 5. Paradoxical Bug.
6. Cynips. 7. Wasp. 8. Horse Ant. 9, 10, 11. Queen Bee, Male Bee, Neuter Bee. 12. Scorpion

body is long, depressed, and consists of numerous transverse segments, each of which is furnished with a pair of legs.

THE GREAT CENTIPEDE *.

None of the Insect tribe, the Scorpions excepted, are so formidable in appearance as the Centipede. It is found in the East and West Indies, and in various parts of Africa, inhabiting chiefly the woods, where it is preyed upon by the different species of snakes. It is, however, sometimes found in houses, and is said to be so common in particular districts, that the inhabitants are obliged to have the feet of their beds placed in vessels of water, in order to prevent their being annoyed during the night by these horrible reptiles.

Gronovius says, that all the legs of this animal are venomous; but its most formidable weapons are the two sharp and hooked instruments, that are placed under the mouth, with which it destroys its prey. At the extremity of each of these there is a small opening, through which it is supposed the Centipede emits the poisonous fluid into the wound inflicted by the fangs.

Leeuwenhoek, desirous of ascertaining some facts relative to the poison emitted by the Centipede, placed a large fly within the reach of one of these animals. He seized it between a pair of the middle feet, then passed it from one pair to the next, till it was brought under the fangs; which were plunged into its body,

* DESCRIPTION. The Great Centipedes vary much both in size and colour. Some of them are of a deep reddish brown, others of a yellow ochre colour, livid yellow, or tinged with red; and they are sometimes seen more than a foot in length. Their legs terminate in very sharp hooks, or nails, of a shining black colour.

SYNONYMS. *Scolopendra morsitans*. Linn.—Great Scolopendra. *Shaw's Nat. Mis.*—Centipede, in the West Indies.—*La Scolopendre mordante*. *Tigny*.

and it died instantly. M. St. Pierre says, that, in the Isle of France, his dog was bitten by a Centipede upwards of six inches in length, and that the wound became ulcerous, and was three weeks in healing. He was highly diverted in observing one of these animals overcome by a vast number of ants, that attacked it in conjunction, and, after having seized it by all its legs, bore it along, as workmen would have done a large piece of timber. The poison of the Centipede is not more injurious than that of the scorpion, and seldom proves fatal to the larger animals.

Some of the American Indians eat Centipedes.

WORMS*.

Intestinal Worms†.

OF THE ASCARIDES IN GENERAL‡.

ALTHOUGH these worms have long been known to inhabit the stomach and intestines of men and animals, their origin and history seem enveloped in great obscurity. The difficulty of making satisfactory observations, and the want of favourable circumstances under which to attend to them, have hitherto presented insuperable obstacles to an intimate knowledge of their habits and economy.

In structure they are very simple, for, being intended to subsist on already-digested food, they are not furnished with any complicated organs. The denomination of *Ascaris* has been given to them from the circumstance of their being almost constantly in motion§.

Some of the species are oviparous, and others produce living offspring.

* For an account of Worms in general, see vol. i. p. 46.

† In the Linnean order of *Intestina*, the animals are simple, naked, and without limbs.

‡ The bodies of these Worms are cylindrical, semi-transparent, and slender at each extremity. The head is furnished with three small vesicles. The intestines are generally spiral, and of a whitish colour.

§ From the Greek word *ασκαρίζω*, *salire*.

THE LUMBRICAL* AND VERMICULAR ASCARIS†.

In the intestines of thin persons, the former of these Worms are frequently found. They are most abundant about the *ileum*, but they sometimes ascend into the stomach, and even creep out at the mouth and nostrils. It does not often happen that they descend into the large intestines, except on the exhibition of medicines which increase the action of the intestines. When very numerous, they give rise to unpleasant, and sometimes even to fatal disorders.

They are supposed to fix themselves by three tubercles at the anterior extremity of their body, whilst, through a small triangular aperture, situated in the centre, betwixt these tubercles, they suck the nutritive juices on which they are supported. Their interior organization appears to consist only of a simple intestine, composed of a fine and very delicate membrane, which is always filled with an orange-coloured liquor.

The motion of these Worms is serpentine, and in no respect resembles that of the Earth-worm, with which they have sometimes been ignorantly confounded. The latter has the power of contracting and extending its body, whilst the length of the *Ascaris* is never diminished. The head is always thrown forward, by the Worm curling itself into circles, and suddenly extend-

* DESCRIPTION. The length of the Lumbrical *Ascaris*, is from twelve to fifteen inches. Its body is semi-transparent, and of a light yellow colour. The head is slightly incurved, with a transverse contraction beneath; and the mouth is triangular.

SYNONYMS. *Ascaris lumbricoides*. Linn.—*Ascaride lombrical*. Bosc. Cuvier.

† DESCRIPTION. This Worm is usually about half an inch in length, somewhat dilated in the middle of the body, and wrinkled at the sides. The head is subulate, and the tail tapers to a fine point. It is of a whitish colour.

SYNONYMS. *Ascaris vermicularis*. Linn.—*Ascaride vermiculaire*. Bosc. Cuvier.

ing its head with considerable force. These worms are oviparous.

The *Vermicular Ascarides* are very common in the intestines of children; and are sometimes found in the stomach. Their number exceeds all calculation, and they cause a most unpleasant sensation of itching, by piercing the skin in a slight degree, with their awl-shaped tails. Even newly-born children are not always free from them.

They are viviparous. The female has, at the distance of about an eighth of an inch from the head, a small punctiform aperture, through which the offspring are protruded. Dr. Hooper, in the Memoirs of the Medical Society of London, informs us, that he has seen upwards of a hundred young-ones escape through this aperture, all alive, and vivacious several hours after the death of the mother.

The present species are sometimes known by the appellation of *maw* or *thread-worms*.

OF THE FASCIOLÆ, OR FLUKE-WORMS.

Fluke-worms are often very numerous in the viscera of quadrupeds, birds, fishes, and reptiles. They are found in the stomach, the intestines, and the liver. Each individual has both the sexes united in itself. They are oviparous, and the ovaries are lateral.

Their body is oblong and flattish, and is furnished with two orifices, one of which is situated at the anterior extremity of the body, and the other at a little distance beneath it. The interior represents an intestinal canal, which, after passing round the body, folds upon itself, and terminates at the second orifice.

THE FLUKE-WORM OF THE SHEEP*.

The livers of sheep which have fed in wet and marshy grounds, generally abound with these Worms; They are also occasionally found in the stomach and intestines; and are sometimes vomited up in brooks where the animals drink. When they are not numerous, the animal feels, or at least appears to feel, no inconvenience from them; but when they fill the biliary ducts, as they often do, the parts become swollen, and they are the source of fatal maladies. The disease called the *rot*, is supposed to be occasioned by them.

These Worms are found in the livers of other quadrupeds besides sheep.

OF THE TÆNIÆ, OR TAPE-WORMS†.

Tæniæ are worms that inhabit the bodies of different animals, where they are destined to feed upon juices already animalized. They are generally found in the alimentary canal, and usually about the upper part of it, where there is the greatest abundance of chyle, which seems to be their natural food.

We are not to suppose that these Worms are created for the purpose of producing disease in the animals

* **DESCRIPTION.** This Worm is about an inch in length, and of a somewhat ovate form. The anterior part of the body is terminated by a small tube. It has a white line down the middle, and a spot in the centre of the body.

ΣΤΙΜΟΥΡΑ. *Fasciola hepatica.* *Linn.*—Fasciole hépatique. *Bos.*—La Douve du Foie. *Cuvier.*—Flounders, in some parts of England.

† The body in the Tape-worms is flat, and composed of numerous articulations; and the head has four orifices for suction, a little below the mouth, which is terminal, and continued by a short tube into two ventral canals. The mouth is generally crowned with a double series of retractile hooks or holders.

they inhabit; but rather, that nature has directed that no situation should be vacant, where the work of multiplying the species of living beings could be carried on. By thus allowing them to exist in each other, the sphere of increase is considerably enlarged. There is, however, little doubt, that worms, and more especially those of the present tribe, do sometimes produce diseases in the bodies they inhabit: but we are at the same time very certain, that worms do exist abundantly in many animals, without disturbing their functions, or annoying them in the slightest degree; and we ought to consider all these creatures rather as the concomitants than the causes of disease.

The species of Tæniæ are not confined *singly* to particular animals: men are subject to several different species, and even the people of particular countries and climates are subject to particular species of them. The people of England have the *Tæniæ solium*, or Common Tape-worm, and rarely any other; the inhabitants of Switzerland the *Tæniæ lata*, &c.

These creatures are apparently possessed of few senses. Nothing resembling brain or nerves has been discovered in them; but, as they are highly sensible to stimuli, it is most reasonable to conclude, that they have a considerable portion of nervous matter in the composition of their bodies; that is, of such matter as is susceptible of stimuli. Indeed, we can scarcely imagine how any animal can even exist without such matter in its composition. Having no particular organs of sense, the touch is therefore the only evident source of intelligence which they possess.

The mode of increase or propagation of Tæniæ, appears to be principally by ova; and there is reason to believe that these ova, as well as those of other intestinal worms, are so constructed, as not easily to be destroyed. From this circumstance, we may suppose them to pass along the circulating vessels of other animals. We cannot easily explain the phenomena of worms being found in the eggs of fowls, and in the in-

testines of a foetus before birth, except by supposing their ova to have passed through the circulating vessels of the mother, and to have been by this means conveyed to the offspring.

THE COMMON TAPE-WORM*.

This animal inhabits the human intestines. Its head is furnished with a mouth, and with an apparatus for giving it a fixed situation. The body is composed of a great number of distinct pieces articulated together, each joint having an organ, by means of which it attaches itself to the inner coat of the intestine; and as these joints are sometimes exceedingly numerous, so of course will be the different points of attachment. The joints nearest the head are always small, and they become gradually enlarged as they are further removed from it, except towards the tail, where a few of the last joints become again diminished. The body is terminated by a small semi-circular joint, which has no opening.

The external parts are clothed with a fine membrane-like cuticle, immediately under which is a thin layer of fibres, lying parallel to each other, and running in the direction of the length of the animal's body. In this direction all its motions are performed; whence we may conclude that these fibres perform the office of muscles.

The head has a rounded opening at its extremity, which is considered to be the mouth. This opening is continued, by a short duct, into two canals, which pass round every joint of the animal's body, and convey the aliment. The head is fixed to its place by means of two small tubercles, concave in the middle, that seem to serve the purpose of suckers. The alimentary canal passes along each side of the animal, sending a cross

* SYNONYMS. *Tænia solium*. Linn.—*Tænia cucurbitain*. Bosc.—*Le Cucurbitain*. Cuvier.—Tape-worm.

canal over the bottom of each joint, which connects the two lateral canals together. The internal structure of the joints is partly cellular, and partly vascular: the substance itself is white, and in its texture somewhat resembles the coagulated lymph of the human blood.

The food of the *Tæniæ*, requiring probably very little change before it becomes a part of their body, is taken in at the mouth, and, being thrown into the alimentary canal, is made to visit, in a general way, every part. The central structure of the vessels placed in each joint, seems calculated to absorb the fluid from the alimentary canal, for the purpose of sustaining and repairing the immediately adjacent parts: but there is in their bodies much cellular substance, into which no vessels enter. Such parts of the bodies of these animals, are possibly nourished by transudation of the alimentary fluid into their cells; or this may be effected by the capillary attraction of their fibres. As they have no excretory ducts, the decayed parts of their bodies are probably dissolved into a fluid, which transudes through the skin like perspiration, and for this purpose the skin is extremely porous.

The length of the present *Tænia* is from three to thirty feet; but some individuals have been known to reach sixty feet, and to be composed of several hundred joints.

When these worms produce a diseased state of body, those remedies (as drastic purges) are supposed to be the most effectual, that operate partly by irritating the external surface of their bodies, so as to make them quit their hold, and partly by violent contractions in the intestines, which may sometimes divide their bodies, or even destroy them by bruising. Electrical shocks, passed frequently through the abdomen, it is supposed, might be beneficial, as the lower orders of animals are in general easily destroyed by electrical shocks.

OF THE FILARIÆ, OR THREAD-WORMS*.

These troublesome animals are found in the bodies of several kinds of quadrupeds, birds, and insects. Most of the species perforate the skin, immediately under which they lodge themselves; a few, however, have been discovered in the intestines. None of them have yet been found to infest the bodies of reptiles or fish.

THE INDIAN THREAD-WORM, OR GUINEA-WORM†.

This species is too commonly found both in the East and West Indies. It enters the naked feet of the slaves, occasions very troublesome itchings, and sometimes excites even fever and inflammation. It particularly attacks the muscles of the arms and legs, whence it can only be extracted by means of a piece of silk or thread tied round its head. But the greatest caution is necessary in this simple operation, lest the animal, by being strained too much, should break; for, if any part remain under the skin, it grows with redoubled vigour, and becomes a cruel and sometimes a fatal enemy.

Dampier tells us, that these worms are no thicker than a large brown thread, but, as he had been informed, are five or six yards long. "If they are broken in drawing out, that part which remains in the flesh will putrefy, be very painful, and endanger the patient's life, or at least the use of the limb; and I have known some

* Their body is round, thread-shaped, and very smooth. The mouth is dilated, and has a roundish, concave lip.

† DESCRIPTION. This worm is of a yellowish white colour, and frequently ten or twelve feet in length, although its thickness is not greater than that of a horse-hair.

SYNONYMS. *Filaria Medinensis*. Linn. Gmel.—*Gordius Medinensis*. Linn. Syst. Nat.—*Dragoneau de Médine*. Bosc.—*Le Ver de Médine*. Cuvier.

that have been scarified and cut strangely to take out the worm." He was unfortunate enough to have one of these creatures in his own ankle. "I was (he says) in great torment before it came out: my leg and ankle swelled, and looked very red and angry, and I kept a plaister to bring it to a head. At last, drawing off my plaister, out came about three inches of the worm, and my pain abated presently. Till that time I was ignorant of my malady, and the gentlewoman at whose house I was, took it for a nerve; but I knew well enough what it was, and presently rolled it up on a small stick. After that I opened the place every morning and evening, and strained the worm out gently, about two inches at a time, not without some pain, till at length I had got out about two feet." He afterwards had it entirely destroyed by one of the negroes, who applied to it a kind of rough powder, not unlike tobacco-leaves dried and crumbled very small.

M. D'Obsonville received in his right leg the germ of one of these worms. He observed that its head was of a chesnut-colour, and that to the naked eye it appeared to terminate in a small black point. On pressing it a little with a pin, and examining it with a common magnifying glass, he fancied he perceived something like a little trunk or tongue, capable of being pushed out or contracted. The body was not thicker than a strong thread; but, when the animal was extracted, it was found to be of the length of two or three ells. It appeared to be formed of a series of small rings, united to each other by an exceedingly fine membrane, and a single intestine extended through the body. This worm was extracted in the usual way; and the reason he gives for the injury done by breaking these animals is, that they are full of a whitish acrimonious fluid, which immediately excites inflammation, and not unfrequently produces an abscess or gangrene. A worm in his leg was twice broken, and twice occasioned an abscess. At last, at his own request, the part affected was rubbed with a preparation of mercury:

and, in eight or ten days, the effect surpassed his hopes; for not only the body of the insect came away in suppuration, but the wound, which had been more than three inches long, and considerably inflamed, was in this time almost entirely healed.

THE FURY TRIBE.

Of this tribe only one species has hitherto been discovered. The body is linear, and of equal thickness throughout. It has on each side a single row of close-pressed reflected prickles.

THE INFERNAL FURY*.

In Finland, Bothnia, and the northern provinces of Sweden, says Linnæus, the people were often seized with an acute pain, confined to a mere point, in the face, or other exposed part of the body, which afterwards increased to a most excruciating degree, and sometimes, even within a few hours after its commencement, proved fatal. This disorder was more particularly observed in Finland, especially about marshy places, and always in the autumn. At length it was discovered, that the pain instantly succeeded something which dropped out of the air, and almost in a moment penetrated and buried itself in the flesh. On more accurate examination, the Fury was detected as the cause. This little worm creeps up the stalks of sedge-grass and shrubs in the marshes, whence it is often carried off by the wind; and, if the naked parts of the skin of any person happen to be directly in its course, it immediately adheres and buries itself within. The first sensation is said to be like that arising from the prick of a needle. This is

* DESCRIPTION. This worm is about half an inch in length, and of a carnation colour, often black at the apex.

SYNONYMS. *Furia infernalis*. Linn.—*La Furie*. Cuvier. *Bosc.*

succeeded by a violent itching of the part; soon afterwards by acute pain, a red spot, and gangrene, and at last by inflammatory fever, accompanied with swoonings. In the course of two days at the furthest, death follows, unless the worm be immediately extracted; which is very difficult to be done. The Finlanders, however, say, that a poultice of curds or cheese, will allay the pain, and entice the animal out. Perhaps the most effectual method is, carefully to dissect between the muscles where it had entered, and thus to extract it with the knife.

Linnæus, as he was once collecting insects, was stung by a Fury in so dreadful a manner, that for a little while there was great doubt whether he would recover.

OF THE GORDIUS, OR HAIR-WORM TRIBE.

These animals are inhabitants chiefly of stagnant waters. In their organization and structure they are extremely simple. Their bodies are round, thread-shaped, equal in thickness throughout, and smooth; and their interior consists of a canal, which extends from one extremity of the body to the other.

THE COMMON HAIR-WORM*.

The popular name of this worm originated in the notion that it was produced from the hair of horses and other animals; a notion that is even yet prevalent among the common people. Its Linnean name of *Gordius* originated in the habit that it has of twisting itself

* DESCRIPTION. This worm is about the thickness of a horse's hair, and, when full grown, is ten or twelve inches in length. Its skin is somewhat glossy, and of a pale, yellowish white, except the head and tail, which are black.

SYNONYMS. *Gordius aquaticus*. *Linnaeus*.—Water Hair-worm. *Barbut*.—Dragoneau aquatique. *Bosc*.—Le Dragoneau des Ruisseaux. *Cuvier*.

into such peculiar contortions, as to resemble a complicated Gordian knot. In this state it often continues for a considerable time, and then, slowly disengaging itself, extends its body to the full length.

It is common in our fresh waters, and particularly in such where the bottom is composed of soft clay, through which it is able to pass with great facility.

Sometimes it moves in the water with a tolerably quick undulating motion, like that of a leech; and at other times its motions are the most slow and languid imaginable. When the water which it inhabited happens to be dried up, it soon loses every appearance of life; the slender body shrivels, and it may be kept in this state for a great length of time. But whenever it is put into water its body soon re-assumes its former appearance; in less than half an hour it begins to move, and in a few minutes more, it is as brisk and active as ever. The Abbé Fontana kept a Hair-worm in a drawer for three years, at the expiration of which time it was perfectly dry and hard, and exhibited no signs of life; but, on putting it into water, it soon recovered its former vigour. When kept in a vessel of water, this worm will sometimes appear motionless, and as if dead, for several hours, and afterward will resume its former vigour, and seem as healthy as before.

It is stated, that the bite of the Hair-worm has been known to produce the complaint called a *whitlow*. This is mentioned by Linnæus as a popular opinion in Sweden. The Hair-worm is sometimes found in the earth as well as in water; and particularly in gardens of a clayey soil, after rain.

THE SEA LONG-WORM*.

Such is the extreme length of these very extraordinary worms, that it is almost impossible to fix any

* DESCRIPTION. The thickness of this worm is from that of a quill, nearly, to that of the little finger. It is generally of

bounds to it. The fishermen of the Devonshire coast, after telling an enquirer respecting them, that they are many fathoms long, and that, although they are continually hauled up from the deep, almost like a rope, their extremity is never found, are satisfied that the enquirer knows enough of the matter; and, in many cases, neither money nor persuasion will induce them to bring specimens of the worms on shore.

Some of the most intelligent of the fishermen, however, assert, that they are upwards of thirty yards in length; but Colonel Montagu is of opinion, that as many feet must be the utmost. None of the specimens which he saw appeared to exceed twenty feet. The largest of these worms are taken by dredging. They are also sometimes found under the stones at low water, but always coiled up or contorted in a most complicated manner.

The expansion and contraction of the Long-worms are very surprising. One of them, supposed to be nearly eight feet in length, was put alive into spirits, and it instantly contracted to about twelve inches, at the same time increasing to double its preceding bulk. It is very difficult to preserve them perfect without contraction. If suffered to die in their natural element, one part will decay and become putrid, whilst the other part remains entire and capable of motion; and the addition of any thing offensive instantly produces contraction.

They are found on the coasts of Devon and Cornwall; and are also frequently dredged up by the fishermen in the Frith of Forth, in Scotland.

a dusky brown colour, with a tinge of green. Five streaks of a paler colour extend through its whole length.

SYNONYMS. *Gordius marinus*. Montagu. Linn. Tran.—*Lineus longissimus*. Black Line Worm. Sowerby's Brit. Misc. p. 15. Pl. 8.

OF THE LUMBRICUS, OR EARTH-WORM TRIBE*.

Some of these worms bore into the earth, others live in mud, and others in the sand of the sea-shores. They are furnished with numerous prickles, which are short, and curved backward. These aid their movements in the ground. Their bodies, likewise, are covered with a viscid matter, which transudes through numerous pores, and assists their progress.

THE DEW-WORM†, AND LUG-WORM‡.

The most insignificant insects and reptiles are of much more importance, and have much more influence in the economy of nature, than the incurious are aware of; and, notwithstanding their minuteness, they are mighty in their effects, from their numbers and fecundity. Dew-worms, in appearance, constitute a small and despicable link in the chain of nature; yet, if this link were destroyed, it would make a lamentable chasm. For, to say nothing of many species of birds and quadrupeds that are supported by them, worms seem to be the great promoters of vegetation. They bore, perforate, and loosen the soil, and render it pervious to rains

* The Earth-worms have a round, annulated body, with generally an elevated fleshy belt near the head. Most of the species are rough, with minute concealed prickles, situated longitudinally, and have in the body a lateral aperture or pore.

† DESCRIPTION. The Dew-worms have a prominent, annulated belt, at about one-third of their length. The fore part of the body is cylindrical, and the rest depressed. They are of a red colour, and furnished with eight lines of prickles.

SYNONYMS. *Lumbricus terrestris*. *Linnaeus*.—Lob-worm, Garden-worm, or Twatchel.—*Le Lombaie terrestre*. *Cuvier*.

‡ DESCRIPTION. This worm differs from the preceding chiefly in having two papillæ at the back of each segment of its body, bearing a small bristle in each.

SYNONYM. *Lumbricus marinus*. *Linnaeus*.

and the fibres of plants, by drawing straws and stalks of leaves and twigs into it; and chiefly, by throwing up infinite numbers of lumps called worm-casts, which form a fine manure for grass and corn.

Gardeners and farmers express their detestation of worms: the former, because they render the walks unsightly, and make them much work; and the latter, because they imagine that worms eat their green corn. But these men would find that the earth without worms would soon become cold, hard-bound, and void of fermentation; and consequently steril. It should also be observed, that green corn, plants, and flowers, are not so much injured by worms, as by many species of insects in a larva state; and by unnoticed myriads of those small shell-less snails called slugs, which silently and imperceptibly make amazing havoc in the field and garden. Lands that are subject to frequent inundations are always poor: one great reason of this may be, because all the worms are drowned.

The body of the Dew-worm is formed of small rings, furnished with a set of muscles, which act in a spiral direction, and enable it, in the most complete manner possible, to penetrate into, or creep upon the earth. The motion of these creatures may be explained by a wire wound on a cylinder; where, when one end is drawn on and held fast, the other, if loosed, will immediately follow. These muscles enable them with great strength to dilate or contract their bodies. The annuli or rings are also each armed with small, stiff, and sharp beards or prickles, which they have the power of opening out, or closing to their body. And under the skin is secreted a slimy matter, which they emit at the perforations between the rings, to lubricate the body, and facilitate their passage into the ground.

Dew-worms make their casts in mild weather, principally about the month of March or April. In rainy nights they travel about upon the ground, as appears from their sinuous tracks, on a soft, muddy soil. This they probably do in search of food. When at night

they appear on the turf, although they considerably extend their bodies, they do not quite leave their holes, but keep their tails firmly fixed, so that on the least alarm, they can precipitately retire under the earth. Whatever food lies within their reach, when thus extended, such as blades of grass, or fallen leaves, they seem content with it.

Helpless as they may appear, these creatures are very vigilant in avoiding such animals as prey upon them. The mole, in particular, they avoid by darting to the surface of the earth the instant they feel the ground move. Fishermen who are acquainted with this circumstance, catch them in great numbers, by moving the earth with a dung-fork in places where they expect to find them. When, however, they are wanted for fishing, they are perhaps most easily caught by the light of a lantern in the night, after heavy showers, on grass walks and sheep pastures, where the herbage is short.

In winter these worms retire very deep into the earth, to secure themselves from being frozen. They do not become torpid during this season; for often, in the intervals of mild weather, they are observed to throw up their casts, in the same manner as at other times of the year.

Lug-worms are marine animals. They frequent those parts of sandy sea-coasts which are left dry by the ebbing of the tides. Here they bury themselves deep in the sand, throwing up a kind of hillock over their holes, in the same manner as the Dew-worms. The fishermen employ them as bait for whiting, cod, and other fish.

OF THE LEECHES IN GENERAL.

The body of the Leech is oblong and truncate, or appears as if it were cut off at both ends. These animals are cartilaginous, and move by dilating the head

and tail, and contracting themselves into the form of an arch.

Some species are viviparous: others are oviparous, and lay their eggs on aquatic plants, or carry them under their belly. Each egg contains many young-ones. Several of the smaller kinds may be multiplied by cutting.

THE MEDICINAL LEECH*, AND HORSE-LEECH†.

In stagnant ponds and ditches these animals are most commonly found. Their body is formed with numerous annular wrinkles, which they have the power of expanding or contracting at pleasure. The tail ends in a circular muscle or sucker, which, when applied to any substance, readily adheres, by the animal's drawing up the middle, so as to have it pressed firmly down by the external air. By this it fastens itself with ease and security, while it extends the other part of its body in any direction; and it is so firmly fixed, that it can move its head about to seek for nourishment, without any danger of being carried away by the strength of the current. When the Leech is desirous of moving onward, it extends its body, fixes its head in the same manner that it did its tail; then loosens and draws that up; and again fastens it near its head, as a fresh point to proceed from.

The head of the Leech is armed with three teeth, of a

* **DESCRIPTION.** This species of Leech is of an olive black colour, with six yellowish lines above, and spotted with yellow beneath. It is generally two or three inches in length.

SYNONYMS. *Hirudo medicinalis.* *Linnaeus.*—*La Sangsue des Chirurgiens.* *Cuvier.*—*Sangsue médicinale.* *Bosc.*

† **DESCRIPTION.** The Horse-leech is of an olive-brown colour, with an ochry yellow margin on each side. It is paler beneath than above, and is sometimes marked with a few black spots.

SYNONYMS. *Hirudo Sanguisuga.* *Linn.*—*Sangsue noir.* *Bosc.*

slightly cartilaginous substance, which are so situated as to converge when the animal bites, and leave a somewhat triangular mark on the skin. These teeth are sufficiently strong to pierce the skin of an ox or a horse. Through the holes it forms with them, it sucks the blood: this is done by contracting the muscles of the throat, so as to make the blood rush through the vacuum above the wound into the stomach, a kind of membranaceous receptacle, divided into twenty-four small cells. Here the blood remains, sometimes for months, and affords support to the animal during the whole time. It passes off by transpiration, the matter fixing on the surface of the body, and afterwards coming off in small threads. In proof of this, if a Leech be immersed in oil, (where it may be kept alive for several days,) and afterward put into water, a kind of slough will be seen to loosen from its skin, exactly of the shape of the body.

The poor people in several parts of the south of England, collect Leeches for sale, and keep, for that purpose, many thousands together, in casks or tubs of spring water. This they change twice a day; or when they are in small numbers, about once in two days. They carefully wash away all the slime and filth which exude from the bodies of the animals. Violent noises are said to be very injurious to Leeches; particularly thunder-storms, after which they often die in great numbers. The effluvium of drugs also is said to be hurtful to them.

It is stated, that a large-sized Leech will generally draw about an ounce of blood. These animals will sometimes adhere so long, and become so much distended, as afterwards to die in consequence. They are, at any time, easily loosened from the skin, by putting upon them salt, pepper, or acids.

The Leech is a viviporous animal, producing one young at a time, and this about the month of July. If confined in a glass and kept in a room, it usually appears very restless before a change of weather.

Horse-leeches are equally, if not more, abundant in ditches and stagnant waters, than the former species. They are so greedy of blood, that a vulgar notion is prevalent, that nine of them are able to destroy a horse. Medical men, in general, are cautious not to use them, from an opinion, though probably a groundless one, that their bite is noxious.

Molluscous Worms*.

OF THE SLUGS IN GENERAL†.

Few animals, for their size, are more voracious than these. They would do serious injury to our fields and gardens, were not their numbers abridged by several of the smaller quadrupeds, and by various species of birds.

They have so strong a tendency to reproduction, that, if the head or tail be cut off, these parts will grow again. Most of the species can exist for a great length of time, even for several months successively, without food.

* The Linnean order *Mollusea* consists of all those simple animals which are without shells, and are furnished with tentacula or arms. The greater number of them are inhabitants of the sea.

† The body of the Slug is oblong, and has on its upper part a kind of fleshy shield; and, below, a flat, longitudinal disk, by means of which the animal has its progressive motion. On the right side of the body there is an aperture. Above the mouth are situated four tentacula, or feelers, at the apex of each of the two larger of which there is an eye.

THE SMALL GRAY SLUG*, AND BLACK SLUG†.

In moist gardens, meadows, fields, and woods, the former of these Slugs is but too common. Its time of going abroad in search of food is in the evening and night. During the day it lies concealed, either among the leaves of vegetables or under the surface of the ground. Its progress on the ground may easily be traced by the slime which it leaves in its track. Few animals are more destructive to vegetation than these.

These Slugs sometimes suspend themselves by a kind of thread, formed from the viscid substance which covers their bodies.

About the year 1789, in a plantation of Scotch firs, Mr. Hoy observed something suspended from one of the branches, which, as it seemed uncommon, he approached, and found to be a Slug. It was hanging, by a single line, or thread, attached to its tail. This, towards the upper part, was very fine; but near the animal it became thicker and more broad, till at length it exactly corresponded with the thickness of the tail. The Slug was about four feet below the branch, and nearly at the same distance from the ground; which it gradually approached at the rate of an inch in about three minutes.

The line by which it descended was drawn from the slimy exudation gradually secreted from the pores that covered its whole body. A great degree of exertion

* DESCRIPTION. The usual length of this Slug is from half an inch to an inch. It is of a grayish white colour, with a yellowish shield. The tentacula are black.

SYNONYMS. *Limax agrestis*. *Linnaeus*.—Spinning *Limax*. *Linn. Tran.*—Spinning Slug.—*Limace agreste*. *Bosc.*—La Petite *Limace grise*. *Cuvier*.

† DESCRIPTION. This species is from one to three inches in length. Its body is black, furrowed, and wrinkled. The shield is whitish, and rough with numerous dots.

SYNONYMS. *Limax ater*. *Linnaeus*.—*Limace noire*. *Bosc. Cuvier*.

seemed necessary to produce a sufficient supply of the liquid, and to force this toward the tail. It alternately pushed out and drew back its head; and turned it as far as possible, first to one side, and then to the other, as if thereby to press its sides, and thus promote the secretion.

This is the substance of Mr. Hoy's account. Dr. Latham says that the secretion from which the thread is formed, is wholly from the under parts of the animal, and not from the back or sides, both of which, during the operation, appear nearly dry. That it did not proceed from any orifice in the tail was evident; for, in some experiments that were made, the animal suspended itself by the tip, and at other times from the side, a full eighth of an inch from the tip. The flow of the viscous secretion toward the tail appeared to be excited by means of an undulating motion of the belly, similar to that of crawling.

After having spun for some time, the power of spinning seemed for awhile to be lost; but in those Slugs on which experiments have been made, this power has always been recovered, by keeping them for some hours among wet moss.

The *Black Slug*, or Snail, is a well-known inhabitant of our fields and meadows, during the summer season. The country people consider the appearance of this Slug as an indication of approaching rain; but this is rather to be accounted for by the moisture of the ground and of the plants. It is seldom indeed to be observed abroad during dry weather, for this would deprive the external parts of its body of the moisture which is requisite for its subsistence. The Black Slug feeds on the roots and leaves of different kinds of plants.

OF THE APLYSIA TRIBE*.

The species of *Aplysia*, (or *Laplysia*, as, by a typographical error this tribe is named, in the *Systema Naturæ*), are only three in number. One of them inhabits the European seas, another the shores of Barbary, and the third the coasts of America.

These animals respire water by means of branchiæ, which form a kind of tuft on the back, and which are covered with an operculum or lid.

THE DEPILATORY APLYSIA †.

There is a general, though very unjust prejudice against this animal. *Pliny* and *Dioscorides* each speak in strong terms of its poisonous properties. "To some (says the former, by his translator, *Philemon Holland*) it is a very poison, if taken inwardly, either in meate or drink; to others again, the aspect and sight thereof is venomous. The same creature is hurtfull, even in the sea, if it be touched onely. Neither is there any living creature that feedeth upon this fish, but it dieth thereupon, unlesse it be the Sea Barbell onely; and all the harme that this fish catcheth by eating of it is this, that the flesh is the more tender. If a man or woman chance to be infected by eating of it, they presently smell and scent of the said fish: and this is the first sign and ar-

* The body is covered with reflected membranes. There is a shield-like membrane on the back; and in the right side an aperture. These animals have four feelers, which resemble ears.

† DESCRIPTION. The body of this animal, which is, apparently, a shapeless mass, enveloped in a loose skin, folding over and nearly meeting on the back, is from two to five inches in length, and of a pale lead-colour. The shield is circular, and on the middle of the back.

SYNONYMS. *Laplysia dipilans*. *Linn.*—*Laplésie depilante*. *Bosc.*

gument to prove that they be empoysoned thereby: howbeit, they die not immediately, but may continue so many daies as the said animal lived after it came out of the sea." It is generally supposed that the hair will fall off those parts of the body which are touched by these animals; and that they cause strangury to those who eat of them.

It is strange, observes Col. Montagu, that the poisonous touch and offensive smell which appear to have been the origin of the name of this *Aplysia*, should, without reason, have been handed down to posterity, and that a most unmerited opprobrium should so long have been fixed upon one of the most harmless and inoffensive of creatures. On the coast of Devon, this gentleman had frequent opportunity of handling these animals, which he invariably did with impunity: they neither affected the hand nor the olfactory nerves; but were found to be as destitute of smell as they are of any depilatory power.

Like the cuttle-fishes, they are furnished with a reservoir, which is filled with a dark-coloured fluid, and which they employ in concealing themselves from the attacks of their enemies. This fluid leaves a beautiful purple stain, and is discharged in such quantity, that it might possibly be turned to some advantage in dyeing, if a method could be devised to fix it.

They inhabit those parts of the sea, in the neighbourhood of rocks and sea-weeds, where the bottom is muddy. Their food consists chiefly of small crabs and shell-fish. They have three strong and muscular stomachs, with pyramidal bony processes, somewhat resembling those so well-known in the lobster.

OF THE AMPHITRITES IN GENERAL*.

There is no tribe of marine animals that exceed these

* The body of these animals is annulate, and projects from a tube. At its anterior extremity there are tentacula, which,

is minute. They consist rather of a heavy or tendinous substance, the greater part of which is buried in the sand, or mud, at the bottom of the sea. From the upper extremity of these tubes, they push out a great number of elegant tentacula, which are arranged about the mouth like rays from the centre of a circle.

The animals are numerous: and several beautiful species have, it was found, been discovered to inhabit the Kingdom of Denmark.

THE HOLLOW-ARMED* AND WIDE-ARMED AMPHITRITE†.

Each of these singular and extremely beautiful animals, is in our possession in the Natural History of the British Islands: and, for the discovery of them, in the neighbourhood of Kingsmidge, Devon, we are in-

which expanded, are arranged like nails from the centre of a circle, and in two divisions. On each side of the body, through its whole length, there is a row of minute peduncles or feet.

* **DESCRIPTION.** The body is long, and consists of from a hundred and fifty to a hundred and sixty joints. These are distinct, and of an orange-colour, with whitish rings. At the base of the tentacula or feelers there is a scalloped membrane. The tentacula are two in number, semicircular when spread, and nearly uniting into a regular circle: they are each composed of about thirty-seven rays, connected by a transparent web, except at the points. Their outside is smooth, and of a purple colour. The inside is elegantly ciliated with two rows of laminae along each ray, of a chestnut-colour, shaded to a purple near the centre. The mouth is purple, and the lips are bordered with chestnut.

SYNONYM. *Amphitrite infundibulum*. Montagu, in *Linn. Trans.*

† **DESCRIPTION.** The length of this species is about five inches, and the tentacula are somewhat more than an inch long. The stem is furnished with long ciliated fibres on one side. The plumes of the tentacula are of a light yellowish brown, banded and mottled with chestnut.

SYNONYM. *Amphitrite voluticornis*. Montagu, in *Linn. Trans.*

debted to the indefatigable researches of Col. Montagu.

The former inhabits a case or tube of a gelatinous but firm and elastic nature. These cases are buried beneath the surface of the sand; and, when uncovered, as they sometimes are, by the lowest ebb of the spring-tides, their situation is only discoverable by a small portion of them above, appearing not unlike a black jelly. When the tide returns, the animals display their beautiful tentacula, but they rarely expose their body. If dug up, and confined in a glass of sea-water, they sicken in the course of a few days; and, if the water be not changed, they soon evacuate their tubes and die.

In their native abode, observes Col. Montagu, (in the Linnean Transactions,) they recede on the least alarm; and when the gelatinous case is taken into the hand, and the animal is extended within it, the sudden contraction, within the tremulous tube, produces a singular and instantaneous vibrative shock to the parts in contact, which, from its being unexpected, creates surprise.

The Funnel-shaped Amphitrites are found in the Estuary of Kingsbridge, near the Salt-stone, but are by no means of frequent occurrence there. Their food is supposed to consist of the smaller species of marine worms. These they guide towards their mouth by a whirling motion, which they make by means of their tentacula.

The *Volulacorn Amphitrite* was taken in the sea near Kingsbridge, in the dredges which are employed for the catching of oysters. The specimen described by Col. Montagu was brought to him alive, in sea-water. In this situation he had an opportunity of examining carefully the curious structure of its beautiful tentacula, which, he says, far exceed, in delicacy, the finest pencil of the artist. They are not retractile, but are capable of greater or less extension.

The interior conformation of these animals appears

to consist chiefly of a stomach and three tubes, similar to intestines, of which one appears to perform the functions of the heart, or at least to form the principal centre of their vascular system.

OF THE NEREIS TRIBE*.

These are all marine animals. They are very various in size; some are invisibly minute, and others are several inches in length. They have been denominated Marine Scolopendræ or Centipedes; and, in some respects, they bear a strong resemblance to these animals.

By numerous legs with which they are furnished, they are enabled to move about among submarine rocks and stones, with considerable agility. Under these they conceal themselves, and lie in ambush for their prey, which chiefly consists of minute worms of different kinds.

THE PELAGIC NEREIS†, AND NIGHT-SHINING NEREIS‡.

The animals of this species reside at the bottom of

* The animals of this tribe are long and slender. Their feet are very numerous, and arranged on each side of the body. They have, in general, two or four eyes, but some of the species have none. Their feelers are simple, and placed above the mouth.

† DESCRIPTION. This species is usually about seven inches in length. The back is convex, and has a scarlet line down the middle. Between the eyes there is a triangular white spot, and there are two others at the sides. The body is of a tawny colour; and the peduncles, or feet, are cirrate and warty.

SYNONYMS. *Nereis pelagica*. Linn.—*Néreië pélagienne*. Bosc.

‡ DESCRIPTION. The Night-shining Nereis is oblong, linear, and so minute as to escape examination by the naked eye. The body, composed of about twenty-three segments or

the sea, among the roots of sea-weeds, concealed beneath stones, and in empty shells. Here they sometimes spin a kind of silken net. They also bury themselves in the sand, occasionally lining their holes with a similar substance. In the places of their concealment they lie in wait for prey, darting the anterior part of their body suddenly out, as any small animal passes them, and seizing it in their powerful jaws.

If one of these animals be cut into two or three parts, the fragments will continue to move for a considerable time afterwards. But all these die except that part to which the head is attached: this recovers from the injury it has sustained, and becomes a perfect animal.

The Pelagic Nereis is not very uncommon on the British coasts.

The *Night-shining Nereis*.—These minute creatures inhabit every sea; and are one of the causes of the luminous shining of the water in the night. They are found on all kinds of marine plants; but often leave them, and swim on the surface of the water. They are frequent at every season of the year, but particularly in summer, before stormy weather, when they become more agitated and more luminous than at other times. So minute are they, that myriads of them may be contained in a small cup full of sea-water. Innumerable quantities of them lodge in the cavities of the scales of fishes; and to them, probably, the fish may, in some measure, be indebted for their luminous quality. "I have observed with great attention (says Barbut) a fish just caught out of the sea, the body of which was almost covered with them; and I have examined them in the dark. They twist and curl themselves with

joints, is scarcely two lines long. It is quite pellucid, and its colour a water-green.

SYNONYMS. *Nereis noctiluca*. *Linnaeus*.—*La Néréide Phosphorique*. *Cuvier*. *Bosc*.

amazing agility, but soon retire out of our contracted sight; probably on account of their glittering numbers dazzling the eye, and their extreme minuteness eluding our researches. These animals do not shine in the day-time, because the solar rays are too powerful for their light, however aggregate, or however immense their number.

Their appearance is particularly brilliant when the wind is in the east and south-east points; and in winter nights, preceded by a warm day. If water containing these animalcules be kept warm, they will retain their light two whole days after they are dead; but in cold weather they lose it in the course of seven or eight hours. Motion and warmth, which increase their vivacity and strength, increase also their luminous properties.

OF THE ACTINIÆ, OR SEA-ANEMONES.

These animals are of a somewhat oblong form, and, when closed, resemble a truncated cone. They are fixed by the base; and from the upper part of their body occasionally extend several tentacula, which are disposed in regular circles. The mouth is situated at the top, in the centre of the tentacula, and is furnished with crooked teeth.

They are all capable of varying their figure; but, when their tentacula are fully expanded, they have the appearance of full-blown flowers. Many of them are of very beautiful and brilliant colours. They feed on shell-fish, and other marine animals, which they draw into their mouth by means of their arms; and they eject the shells and other indigestible parts through the same opening. It, however, sometimes happens, that a shell presents itself in a wrong position, and the animal is not able to discharge it in the usual manner: in this case, we are told that the shell is forced through the body, making a wound, as if with a knife, near the base. The arms of the Sea-anemones seem to lay

hold of objects by making a vacuum; for on touching them with the fingers, they readily adhere, but no viscous matter is deposited by them. The mouth of these animals is capable of great extension, so as to allow them, without injury, to swallow very large shells. The whole interior of their body is one cavity or stomach. They have the power of progressive motion; but this is extremely slow, and is said to be performed by loosing their base from the rock, reversing their body, and employing their tentacula as legs.

Nearly all the animals of this tribe may be separated from the rocks by a card carefully introduced beneath, so as not materially to injure them; and, if put into glass vessels with sea-water, which must be changed about once a week, they will there fix themselves, and may be kept alive and in full vigour for a great length of time, even in places far distant from the sea-coasts.

All the species are viviparous.

THE COMMON OR PURPLE SEA-ANEMONE*.

On the submarine rocks of several of the European coasts, and on those of the British islands in particular, these animals are extremely abundant. They adhere by their base so firmly to the rocks, as frequently to be left above water at the ebbing of the sea: but they are generally found at a little depth below the surface. When closed, their form is that of a rounded cone, with an orifice at the top. This they can at pleasure either close entirely, or extend very wide, to admit their tentacula to spread out, and to receive such food as these draw into it. The tentacula, when fully expanded,

* DESCRIPTION. The exterior of the body is smooth, and of a purple or dark red colour, sometimes striped with green. The tentacula are red; and round the mouth there is a row of small blue spots.

SYNONYMS. *Actinia anemonoides?* Linn.—*Actinie pourpre*. *Actinia purpurea*. Cuvier.

somewhat resembles the petals of the red garden-anemones. If any extraneous substance be introduced into the cavity of the mouth, or even if any of the tentacula are but slightly touched, the animal instantly contracts itself into a conoid shape, and swallows it.

If kept in a vessel of salt-water, they will continue to live and flourish for a considerable length of time. It is, however, remarkable, that when from want of the water being changed, they become unhealthy, they protrude their intestines at the mouth, and at length turn inside out, their mouth closing round the base. On renewing the water they will sometimes recover, and assume their natural shape and appearance.

These creatures occasionally assume many extraordinary shapes. When detached from the glass in which I have kept them, I have known them sometimes to appear as if composed of two small conjoined spheres, sometimes to become extended and nearly cylindrical, and sometimes to have a stricture below the orifice, at the upper part of the body, appearing as though they were tied tightly round with a slender string.

THE ROSE-COLOURED SEA-ANEMONE*.

On this species the Abbé Dicquemaire made several experiments, to ascertain its powers of production, and other remarkable properties. He first cut off all the tentacula: these grew again in less than a month; and, on repeating this apparently cruel operation a second and third time, he had equal success. One of the animals had its upper part cut off: the base was found, a

* DESCRIPTION. When the tentacula are fully expanded, this beautiful species sometimes measures five or six inches across. These tentacula are of a pale rose-colour. The mouth is also rose-coloured, but darker. When the animal is closed, its exterior is greenish, and covered with numerous warts.

SYNONYMS. *Actinia rufa?* Linn. Gmel.—*Actinia equina*. Linn. Syst. Nat.

few days afterward, to have fallen from its place, but it soon entirely recovered its limbs. After cutting one of these anemones in two, the Abbé offered a piece of a muscle to the detached part, and the limbs seemed eager to take it. They drew it into the mouth, and it was swallowed; but, as the body was wanting to receive it, the piece came out at the opposite end; "just (says the Abbé) as a man's head, being cut off, would let out at the neck the bit taken in at the mouth." It was offered a second time, and again received and retained till the following day, when it was thrown up. In this manner it was fed for some time, the bits, when they did not pass through, appearing considerably altered on their re-appearance at the mouth. If the base of any of the Anemones happened to be injured by the incision, the wound generally proved mortal.

On being put under the receiver of an air-pump, and having the air exhausted, these animals did not seem to experience any ill effects, nor to perceive any difference betwixt this and their being in the open air: if their tentacula happened to be expanded, they remained so, and not the least shrinking could be perceived.

Some of them lived upwards of twelve months, without any other food than what the sea-water afforded them.

When shell-fish, or pieces of other fish, or bits of raw meat were offered, if not too large, they always seized them. The shells, even if closed, they ejected in the course of a day or two, but perfectly cleared of their contents.

The Sea Anemones produce their offspring alive at the mouth; and the Abbé several times had these ejected on his hands, from eight to twelve in number. Though some of them were so small as to be almost imperceptible, they immediately fixed themselves, and expanded their tentacula, in order to catch their prey.

These animals are destitute of eyes, yet they are very evidently affected by light. If a candle be held

over the glasses in which they are kept, and at such a distance as not to communicate any heat, they regularly close, and do not again expand until the light is removed.

Among other experiments of the Abbé Dicquemaire, he gave to two *Actiniæ* of different species, a narrow slice of fish, so laid, that each of them had hold of an end. The yellow one, however, happened to seize the larger share. Each swallowed on by its respective end, till at length their mouths came in contact. The gray one seemed at first to get the better; but the other soon recovered its share, lost it again, and again recovered it. These alternate victories lasted about three hours, till at last, the gray one losing its hold, the other obtained the prize. This sucked it in but slowly, and the gray one again ventured its mouth upon a last tug at the end still within reach; but the effort proved fruitless; the yellow companion gave a final pull, and swallowed the whole.

When the Sea Anemones are boiled in water, they acquire a firm consistence, and become a very palatable food. Cats are remarkably fond of them when thus cooked. Their smell is not unlike that of a warm crab or lobster.

THE SEA-MARIGOLD*.

Mr. Hughes, in his Natural History of Barbadoes, has given us a very accurate account of this species, several individuals of which were, some years ago, discovered in that island. He calls it an animal flower, and seems to have considered it as a sensitive plant, possessing many animal properties.

* DESCRIPTION. The stem of this species is sub-turbinate; and its disk is surrounded with petal-shaped tentacula or rays. The disk is furnished with four dark-coloured threads or arms, which close together like a forceps, and secure its prey.

SYNONYM. *Actinia calendula*. *Lin.*

"The cave which contained these animals was (he says) near the bottom of a rocky cliff facing the sea, at the north part of the island, in the parish of Saint Lucy. The descent to it was steep and dangerous, being in some places almost perpendicular. The cave contained a natural basin of water, about sixteen feet long, and twelve broad, in the middle of which was a rock almost covered with them.

"Round the sides of this, at different depths under the water, seldom, however, more than eighteen inches, were observed at all times of the year, what seemed to be fine radiated flowers, of a pale yellow, or a bright straw-colour, slightly tinged with green. These had the appearance of a circular border of thick-set petals, about the size of, and much resembling, those of the single garden marigold.

"I often attempted to pluck one of them from the rock to which they are fixed, but could never effect it: for, as soon as my fingers came within two or three inches of it, it would immediately contract, close together its yellow border, and shrink back into the hole in the rock; but, if left undisturbed for three or four minutes, it would again come gradually into sight, expanding, though at first very cautiously, what seemed its leaves, till at last it appeared in its former bloom: it would, however, again contract, with surprising quickness, when my hand approached within a little distance of it.

From the centre of this apparent flower proceeded four dark-coloured threads, somewhat resembling, says this gentleman, the legs of a spider. These, which were its arms or feelers, had a quick, spontaneous motion from side to side.

Its body seemed to be a dark-coloured tube, about as thick as a raven's quill; one end of which was affixed to the rock, and the other, which extended a little way from it, was encircled with the yellow border above mentioned.

Soon after the discovery of these surprising animals,

great numbers of people came to see them. This was attended with considerable inconvenience to the person through whose grounds they were obliged to pass, and he resolved to destroy the objects of their curiosity. That this might be done effectually, he caused all the holes, out of which the animals appeared, to be carefully drilled with an iron instrument. He could not, however, even by this means, destroy them; for in the course of a few weeks they again appeared in the very same places, and, in a short time, became as numerous as before.

OF THE SEPIA, OR CUTTLE-FISH TRIBE.

The structure of these animals is very remarkable. Their body is cylindrical, and, in some of this species, entirely covered with a fleshy sheath; in others, the sheath reaches only to the middle of the body. They have eight tentacula or arms, and in general two feelers, as they are called, which are much longer than the arms. Both the feelers and arms are furnished with strong circular cups or suckers. The mouth of these animals is hard, strong, and horny, resembling, both in texture and substance, the beak of a parrot.

In the back, under the skin, there is a kind of bone, composed of thin parallel plates, one above another, and separated by little columns, arranged in quincunx order. This bone is oval, thick toward the middle, and thin at the edge. It is extremely light, generally elastic, and, in the living animal, is transparent, like glass: the surface, in some species, is marked with longitudinal furrows.

THE OFFICIAL* AND EIGHT-ARMED CUTTLE-FISH.

By means of the numerous circular cups or suckers

* **DESCRIPTION.** The body is ovate, and surrounded by a margin, which is interrupted at the posterior part. There are

with which the arms of both these species are furnished, they seize their prey, and firmly attach themselves to rocks or other hard substances. In order to do this, they apply the surface of the suckers, extended and plain, to the surface of the body to which they are about to adhere: then, drawing them up in the centre, by the muscles contrived for that purpose, a vacuum is formed, and they are fixed by the pressure of the external air. Their adhesive power is so great, that it is generally more easy to tear off the arms, than separate them from the substance to which they are fixed. If the arms happen to be broken off, they are soon afterwards re-produced.

The beak of these animals is so strong and powerful, that they are enabled, by means of it, to break in pieces the shells of limpets, and of other marine testaceous animals, on which they feed.

In the belly not only of these, but of all other species of Cuttle-fish, there is a vessel that contains a quantity of dark or inky fluid, which the animal emits, on contraction, when alarmed. This not only tinges the water so as to conceal its retreat, but is at the same time so bitter, as immediately to drive off its enemies.

Th' endangered Cuttle thus evades his fears,
And native hoards of fluid safely bears.
A pitchy ink peculiar glands supply,
Whose shades the sharpest beam of light defy.
Pursued he bids the sable fountain flow,
And, wrapt in clouds, eludes th' impending foe.
The fish retreats unseen, while self-born night,
With pious shade, befriends her parent's flight.

Swammerdam was of opinion, that *Indian ink* was

eight short and pointed arms, and two tentacula, which are four times as long as the arms. These are rounded, and the tips are very broad, and furnished with numerous suckers,

SYNONYMS. *Sepia officinalis*. Linn.—*Sèche Commune*.
Bosc.—*La Seiche Commune*. Cuvier.

this black fluid in an inspissated state, with the addition of perfumes. If Indian ink be, in any considerable quantity, dissolved in water, it acquires, in a few days, a very high degree of putridity, clearly indicating its being formed of some animal substance; and no other seems so well calculated to compose it as this.

The male always accompanies the female, and, when she is attacked, will brave every danger, and will attempt her rescue, even at the hazard of his own life. As soon as she observes her partner to be wounded, she immediately escapes, her timidity not suffering her to afford him any assistance. When these animals are dragged out of the water, they make a noise somewhat like the grunting of a hog.

The young-ones are produced from eggs deposited in parcels on marine plants: those of the officinal species, exactly resembling a bunch of grapes. The eggs are at first white, but, after their impregnation, they become black: they are round, with a little point at the end, and in each of them is contained a Cuttle-fish, surrounded by a gelatinous fluid.

The Officinal Cuttle-fish has in its body a bone, which, when dried and pulverized, is employed by silversmiths for moulds, in which they cast their small work, such as spoons, rings, &c. It is also converted into that useful article of stationery, called pounce. This bone, on account of its lightness, is sometimes called sea-foam, or sea-biscuit.

This species was held in great esteem by the ancients as food, and it is even yet used as such by the Italians, and the inhabitants of other countries on the shores of the Mediterranean.

*The Eight-armed Cuttle-fish**, in hot climates, some-

* DESCRIPTION. The body is short, and rounded at the posterior part. There are eight arms, which taper to a point, and are joined at the base by a membrane or web, and covered

times become of such size, as to measure twelve feet across its centre, and to have each of its arms between forty and fifty feet long. When the Indians go out in their canoes, in places frequented by these animals, they are always in dread of their flinging their arms over and sinking them; on which account they are careful to take with them an axe, to cut them off.

OF THE ASTERIAS, OR STAR-FISH TRIBE.

These are inhabitants of the sea, and are usually found on the sand, or among the rocks on the seashore, considerably below high-water mark. Their covering is a coriaceous crust, which defends them from the attacks of the smaller animals; and they have five or more rays proceeding from a centre, in which their mouth is situated. Every ray is furnished with a prodigious number of tentacula, or short, soft, and fleshy tubes, which appear to be of use not only in taking prey, and in aiding the motion of the animal, but also in enabling it to adhere to rocks and other substances, by which it withstands the force of the waves. In a single animal the tentacula have been found several hundred in number; and, when the Star-fish are thrown on their backs, these are frequently pushed out and withdrawn, in the same manner as snails do their horns. The progressive motion of the Star-fish, which is performed by the undulation of their rays, is very slow. They possess considerable powers of re-production; for, if a ray happen to be broken off, a new one, in the course of a short time, will appear. The mouth is armed with bony teeth, that are used in seizing and breaking the shells on which the animals feed; and from the mouth a canal extends to

on one side with two rows of alternate suckers. There are no pedunculated tentacula, as in the last species.

SYNONYMS. *Sepia Octopus*. Linn.—*Sèche Octopode*. Bosc.—*Le Poulpe Commune*. Cuvier.

300 THE COMMON OR FIVE-RAYED STAR-FISH.

each of the rays, runs through the whole length; and becomes gradually narrower as it approaches the extremity.

If Star-fish be drowned in brandy or spirit of wine, and the rays be kept flat and expanded, it is easy afterwards to extract, by a pair of forceps, the stomach and intestines through the mouth. This information may be of use to persons who wish to preserve specimens of these animals.

THE COMMON OR FIVE-RAYED STAR-FISH*.

In a large animal of this species, which I kept by me for some time alive, there were more than 4000 tentacula on the under sides of the rays. These the creature frequently retracted, and again pushed out, as a snail does its horns; and by means of them, it was enabled firmly to adhere to the dish of salt-water in which it was kept. Whenever I touched the tentacula with my finger, all those of that ray or limb were gradually withdrawn, but those of the other rays were not in the least affected by it.

It is stated, that these animals, which are extremely common in some seas, feed on oysters, and are consequently very destructive to them. This, however, if it relate to full-grown oysters, must be incorrect, as, when alive, the Star-fish are so soft and tender, that an oyster, in closing upon them, would either cut off their limb, or, at least, would injure it to such a degree, that when it next opened its shell, the animal would be glad to make its escape. Besides, the mouth of the Star-fish being in the centre of the under part of its body, I

* DESCRIPTION. The rays are five in number, and each of them is angular. At the angles there are prickly protuberances. When alive these animals are usually of a brownish white colour.

SYNONYMS. *Asterias glacialis*. Linn.—*Asterie glaciale*. Bosc.

know not in what manner this could possibly come in contact with food defended by two such large and powerful shells as those with which the oyster is furnished. It has been said, that the tentacula are of use in taking this prey; but this, from their nature, must be entirely fabulous.

Like the other species, these animals breathe by means of a kind of branchiæ or gills, which consist of a fringed substance extending along each ray, and communicating with the stomach. These all unite under a small circular and striated operculum, or cover, which may be observed on the back.

THE ARBORESCENT STAR-FISH*.

This extremely singular species is occasionally found in most seas, but never in great numbers. It has five equi-distant, thickly-jointed processes, which proceed from its centre, each divided into two small ones, and each of these into two others still smaller; and this regular subdivision is continued to a vast extent, and, in the most beautiful gradation of minuteness, till at length the number of extreme ramifications sometimes amounts to several thousands. One specimen, that measured three feet across, had five hundred and twelve extremities to each ray; so that the whole number was 2560. By this most curious structure, the Arborescent Star-fish becomes as it were a living net, and by the sudden contraction of its innumerable ramifications, it is capable of catching such creatures as are destined for its prey: and the unfortunate object of attack is secured by these, beyond all possibility of escape.

In order to preserve this curious animal whole and undamaged for cabinets, it should be taken far out in the sea; and the fishermen ought to be careful not to break off any of the limbs, and to prevent the animal

* **SYNONYMS.** *Asterias Medusæ.* Linn.—Magellanic Star-fish. Basket-fish. Branched *Asterias*. *Medusa* Star-fish.

from contracting and entangling its outer and most slender branches. The fishermen of the Cape of Good Hope procure these Star-fish, and sell them for six, and sometimes even ten rix-dollars each.

When it is alive, or but just dead, the colour of the Arborescent Star-fish is reddish or deep carnation; but, on being dried, it becomes somewhat gray. It should be dried in the shade, in some open place, where the wind has free access to it; for in the sun it is apt to dissolve, and if placed too much in the shade it will become putrid.

OF THE ECHINUS, OR SEA-URCHIN TRIBE.

The Sea-urchins are generally round, and shaped like a somewhat flattened ball. Their exterior is a bony crust, usually furnished with movable spines, by which they are defended from injury, and by means of which they have their progressive motion: these are often very numerous, amounting, in some species, to upwards of two thousand. The mouth is placed beneath, and, in most of the species, has five valves.

They are all inhabitants of the sea.

THE COMMON OR EATABLE ECHINUS*.

The spines with which the shell of this animal is covered, are the instruments by which it conveys itself at

* **DESCRIPTION.** This animal, which lodges in cavities of rocks just beneath low-water mark, on most of the British coasts, is nearly of a globular shape, having its shell marked into ten partitions or divisions, not much unlike those of an orange. The mouth is situated in the lower or under part, and is armed with five strong and sharpened teeth. On the outside of the shell there is a prodigious number of sharp, movable spines, of a dull violet and greenish colour, curiously articulated, like balls and sockets, with tubercles on the surface, and connected by strong ligaments to the skin or epidermis with which the shell is covered.

SYNONYMS. *Echinus Esculentus. Linn.*—Eatable Echi-

pleasure from one place to another; and by means of these it is enabled to move at the bottom of the water with great swiftness. It generally employs those about the mouth for this purpose, keeping that opening downward; but it is also asserted to have the power of moving forward, by turning on itself like a wheel. When any thing alarms these animals, they immediately move all their spines toward the object, and wait an attack, as an army of pikemen would with their weapons. The number of muscles, fibres, and other apparatus necessary to the proper management of these, are very great, and exceedingly wonderful. So tenacious are the Sea-urchins of the vital principle, that, on opening one of them, it is no uncommon circumstance to observe the several parts of the broken shell move off in different directions. The ancients, according to Opius, give credence to a circumstance much more wonderful than this:

Sea-urchins, who their native armour boast,
All stuck with spikes, prefer the sandy coast.
Should you with knives their prickly bodies wound,
Till the crude morsels pant upon the ground;
You may e'en then, when motion seems no more,
Departing sense and fleeting life restore.
If in the sea the mangled parts you cast,
The conscious pieces to their fellows haste;
Again they aptly join, their whole compose,
Move as before, nor life nor vigour lose.

Between the spines, and disposed in a longitudinal series on the several divisions or regions of the shell, are an infinite number of very small foramina or holes, communicating with an equal number of tentacula placed above them. They are possessed of a very high degree of contractile power, and are furnished at the extremities with an expansile part, which may be sup-

posed to operate as a sphincter, or as the tail of a leech, in fastening the animals securely to rocks and other substances to which they choose to adhere.

In Marseilles, and some other towns on the continent, this species of *Echinus* is exposed for sale in the markets, as oysters are with us, and is eaten boiled like an egg. It forms an article of food among the lower class of people who reside in the neighbourhood of the sea-coasts of many parts of this country, but does not seem to have made its way to the tables of the opulent. The Romans adopted it as food, and dressed it with vinegar, mead, parsley, and mint.

Testaceous Worms, or Shell-Fish*.

Multivalves.

OF THE LEPAS, OR BERNACLE TRIBE.

It is the nature of these animals to adhere in clusters to rocks, shells, the bottoms of ships or floating pieces of wood.

The shells are fixed at the base by a long and flexible kind of neck, and consist of more than two unequal and erect valves. The animal that inhabits them is similar to one which inhabits submarine rocks, and which Linnæus has placed among the *Mollusca*, under the name of *Triton*.

THE GOOSE-BEARING BERNACLE †.

There was formerly a strange notion prevalent con-

* The Linnean order *Testacea*, comprises all those Molluscous Worms which are covered with calcareous shells.

† DESCRIPTION. The shell of the Goose-bearing Bernacles

cerning these shells, that from them was bred a species of goose, common in some parts of our island, called the Bernacle Goose*. Even of late years an attempt was made to impose upon the credulity of the public, by an exhibition in London of a large collection of these shells, as shells from which, as the advertisements stated, the Bernacle Geese were produced.

To the bottoms of ships, and to pieces of floating timber, these Bernacles are sometimes seen adhering in countless numbers. Colonel Montagu observed a piece of fir timber, more than twenty feet long, which was drifted on the coast of Devonshire, and which, from end to end, was completely covered with them. They appear particularly to attach themselves to wood, where they cluster together of all sizes, the smaller adhering, by short pedicles, to the larger ones.

The animals contained in these shells, as well as in those of all the other species, have each twenty-four claws or tentacula, all joined in pairs near the bottom, and inserted into one common base. The twelve longest stand somewhat erect and arched, and arise from the back part of the animal. They appear like so many yellow curled feathers, clear, horny, and articulated. Every joint is furnished with two rows of hairs on the concave side. They are of use in catching prey, and the animals are continually employed in extending and contracting them for this purpose.

The twelve smallest tentacula are placed, six on each side, in front of these. They are more pliable and more thickly set with hairs than the others, and seem to perform the office of hands. The mouth, formed

have each five smooth valves; and of these the dorsal valve is rounded at the sides, and slightly carinate. The shells are about an inch and a half long, and the peduncle or neck two or three inches. The valves are yellow at the margins.

SYNONYMS. *Lepas anatifera*. *Linnaeus*.—*L. Anatifæ* *lisse*. (*Anatifæ lævis*.) *Cuvier*. *Bosc*.

* See the account of this bird, in vol. iii. p. 95.

not unlike a contracted purse, is in front, between the smaller tentacula; and within its folds are situated six or eight horny laminae or erect teeth. Under this lie the stomach and intestines, and the tendons, by which the animal adheres to the shell.

OF THE TEREDO TRIBE*.

There are not more than four known species of Tere-
do. Of these, two are found in holes, which they per-
forate in wood; a third, in the seed-vessels of a plant
which grows in the East Indies, and called, by Linnæus,
Xylocarpum Granatum; and the fourth, (the Gigantic
Teredo,) in mud at the bottom of the ocean, on the
coast of the island of Battoo, near Sumatra. The shells
of the latter are sometimes betwixt five and six feet in
length.

These animals were formerly arranged with the more
simple of the univalve shells, but their proper place is
certainly among the multivalves.

THE SHIP-WORM†.

Great numbers of these destructive worms, which are
supposed to have been introduced from India into Eu-
rope, are sometimes found in the sides and bottoms of

* The shell of the Tere-
do has two principal hemispherical
valves, truncated and open at the end; and two small lanceolate
accessory valves, remote. The hinge is furnished with a long
incurved tooth in each valve. The tube in which the animal
resides is testaceous, and somewhat cylindrical. The animal is
an *Ascidia*.

† DESCRIPTION. The Ship-worm, when full-grown, is in
general from four to six inches in length, of a gray colour, and
about the thickness of the middle finger. It is covered with a
whitish, thin, cylindrical, and smooth shell; and has, in front
of the head, two small hemispherical valves, flat before, and
angular behind.

SYNONYMS. *Teredo navalis*. Linn.—*Serpula Teredo*. *Da*
Costa.—*Le Taret Naval*. *Bosc*.

ships. By means of their hard and cutting jaws, they are able to penetrate into any timber, except such as is of an extremely hard and compact substance. They, however, bore as seldom as possible across the grain; for, after they have penetrated a little way, they turn, and continue with the grain tolerably straight, until they meet with another shell, or knot. Their course then depends on the nature of the obstruction: if this be considerable, they prefer making a short turn back, in form of a syphon, rather than to continue for any distance across.

Col. Montagu states, that he had an opportunity of examining a great number of these shells in the Dock-yard at Plymouth, where every possible means have been tried to prevent the ravages which are committed by them. Although they have not been known in this country more than fifty or sixty years, they are now become naturalized to our climate, and have, of late, very considerably increased in numbers. Piles of solid oak, which had not been in the water more than four or five years, were found, on examination, to be perforated by them.

In the year 1730, the inhabitants of the United Provinces were under serious alarm concerning these worms, which had made dreadful depredations in the piles that support the banks of many parts of their coasts. One of the persons who had the care of the coasts at that time, observed, to his astonishment, that some of the timbers, in the course of only a few months, had been made so full of holes, that they could be beaten to pieces with the least force.

Although, when the mud was scraped off, the perforations did not appear much larger than to admit a pin's head, yet the piles, on being split lengthwise, were found full of large passages, or hollow, cylindrical ducts, each of which contained a worm, enclosed in its testaceous tube, which it exactly filled.

The most efficacious method which has hitherto been discovered, to preserve timber from the ravages of these

worms, is that which is now adopted in the Dock at Plymouth, to cover all the parts that are under water with short, broad-headed nails. These soon cover the whole surface with a strong coating of rust, which is found to be altogether impenetrable to the animals.

OF THE PHOLAS TRIBE*.

The animals of this tribe, while very young, perforate clay, spongy stones, and wood; and, as they increase in size, they enlarge their habitation within, and thus become imprisoned. They are always found below high-water mark, and a mass of rock may sometimes be seen wholly perforated by them. They have two orifices, or openings, capable of elongation in the manner of a proboscis: one of these is supposed to be the mouth, and has the faculty of spouting water. Most of them contain a phosphorescent liquor, of great brilliancy in the dark, which also illuminates whatever it touches or happens to fall upon.

From the following species, the character of nearly the whole tribe may be collected.

THE DACTYLE PHOLAS†.

The very extraordinary powers possessed by these animals, of penetrating into solid bodies, when compared

* The Pholas has a shell of two valves, that open widely at each end, with several lesser ones at the hinge. The hinges are folded back, and united by a cartilage; and in the inside, beneath the hinge, there is a long, incurved tooth. The animal contained in this shell is an *Ascidia*.

† DESCRIPTION. This is an oblong shell, marked with somewhat spinous stripes. When full grown, it is about an inch and a quarter deep, and nearly five inches broad. It is of a whitish colour, and, in its general external form, has a distant resemblance to a muscle.

SYNONYMS. *Pholas dactylus*. *Linnaeus*.—*Pholade dactyle*. *Bosc.*—*Pholas muricatus*. *Da Costa*.

with their apparent imbecility, have justly excited the astonishment of philosophers and naturalists in all ages. When divested of their shells they are roundish and soft, and seem destitute of any instrument fitted for boring into stones. They are, indeed, each furnished with two teeth; but these are placed in such a situation as to be incapable of touching the hollow surface of their stony dwellings. They have also two corners to their shells, that open and shut at either end; but these are totally unserviceable to them as miners. The instrument with which they perform all their operations, and by means of which they bury themselves in the hardest rocks, is a broad fleshy substance, somewhat resembling a tongue. With this soft, yielding instrument, while yet young and small, they work their way into the substance of the stone, and enlarge their apartment as their increasing size requires.

The seeming unfitness of these animals, for penetrating into rocks, and there forming a habitation, has induced many philosophers to suppose that they entered the rock while it was yet in a soft state, and that, from the petrifying quality of the water, the whole rock afterwards hardened round them by degrees. This opinion, however, has been confuted, and, in a very satisfactory manner, by Dr. Bohads, who observed that many of the pillars of the temple of Serapis, at Puteoli, were penetrated by these animals. He justly concludes, that the Pholades must have pierced them after they were erected; for no workmen would have laboured a column into form, if it had been honey-combed by worms in the quarry. In short, there can be no doubt that the columns were perfectly sound when erected, and that these animals attacked them during the time they were buried under water, after the earthquake that swallowed up the city.

Hence it appears that, in all nature, there is not a greater instance of perseverance and patience, than that which this animal is seen to exhibit. Furnished with the bluntest and softest augur imaginable, it effects, by

slow successive applications, what other animals are incapable of performing by force, and penetrates the hardest bodies with only its tongue. When, while yet small, it has effected an entrance and buried its body in the stone, it there continues, for life, at its ease; the sea-water that enters at the little aperture, supplying it with luxurious plenty. On this seemingly thin diet it by degrees grows larger, and soon finds itself under the necessity of increasing the dimensions of its habitation and its shell.

The motion of the Pholas is slow, almost beyond conception; its progress keeps pace with the growth of its body; and, in proportion as it becomes larger, it makes its way further into the rock. When it has penetrated to a certain depth, it turns from its former direction and hollows downward; till at last, when its habitation is completed, the whole apartment resembles the bowl of a tobacco-pipe; the hole in the shank being that by which the animal entered.

Thus immured, the Pholas lives in darkness, indolence, and plenty: it never removes from the narrow mansion into which it has penetrated; and seems perfectly content with being enclosed in its own sepulchre. The influx of the sea-water that enters by its little gallery satisfies all its wants.

These animals are found in immense numbers at Ancona, in Italy. They are also found along the shores of Normandy and Poitou, in France, and some of the coasts of Scotland. In general they are considered a great delicacy at the tables of the luxurious.

Bivalves.

OF THE MYA TRIBE*.

Most of these animals are inhabitants of the ocean, but some of them are found in fresh water. They per-

* The shell, in most of the species, is gaping at the end.

forate the sand or mud at the bottom, where many of the species are caught for food, and others for the pearls which are formed within their shells. Some few of the species perforate and live in lime-stone, in the same manner as the pholades.



THE PEARL-BEARING MYA*.

The rivers Tay in Scotland, and Conwy in Wales, are each celebrated for producing, in great abundance, the Pearl-bearing Mya. Some of the shells, in each river, contain good pearls, but fine ones are by no means numerous. Few of them have any lustre; some are round, oval, or elongated and cylindrical; and others are hemispherical, and somewhat resemble buttons.

The origin of pearls in these shells has been thus accounted for. The Mya which produces them is attacked by several kinds of enemies. Of these, there is one which penetrates into the inside, by working a longitudinal passage between the different laminæ that compose the cover. This small channel, after extending about an inch and a half in length, doubles back in a line parallel to the first, and separated from it by a thin partition of shelly matter. These two parallel lines discover the direction of the worm in entering and returning. This is also distinguishable on the surface, by two small holes close to the edge, and in general near the mouth of the shell. As these small channels are excavated in the part nearest to the mother-of-pearl, or

The hinge is furnished with a strong, thick, and broad tooth, not inserted into the opposite valve. The animal is an *Ascidia*.

* DESCRIPTION. This shell is about two inches long, and five broad, oblong, and somewhat narrower in the middle than at the ends. It is covered with a dark-coloured, rough epidermis, or skin, except on the protuberant parts near the hinge. There is a single tooth in one of the valves, which locks into a forked one in the other.

SYNONYM. *Mya margaritifera*. Linn.

silvery internal coat, the pearly juice soon extravasates, and protuberances are formed in that direction. The cylindrical bodies thus formed may be considered as elongated pearls, adhering to the internal lining of the shell. When several worms of this kind penetrate near each other, and unite their labours, the result is a sort of pearly wen, with irregular protuberances, in which the issues of the several passages are easily perceptible.

There are other kinds of worms which pierce the pearl-shell, and form cavities more or less round, in which the juice consolidates into pearls.

It was doubtless this observation that first suggested to Linnæus and others, the idea of making artificial perforations in the shells, and thus forcing them to produce pearls. M. Saint Fond, when in London, saw some pearls which had been brought from China, and which had undergone this operation. The artificial hole in these was filled with a piece of brass wire, rivetted on the outside of the shell like the head of a nail; and the part of the wire which pierced the interior shining coat, was covered with a well-shaped pearl, which seemed as if it had been soldered to the extremity of the wire. It is probable that with the Chinese this is not a discovery of very modern date.

M. Saint Fond was informed of another mode of obtaining pearls. The shell from which the pearl is to be obtained must be opened with the greatest care, in order to prevent the animal from being injured. A small portion of the inner surface is then to be scraped off, and a spherical piece of mother-of-pearl, about the size of a small grain of shot, is to be introduced. This globule serves as a nucleus to the pearly juice, which concretes around it, and after a certain time produces a fine pearl.

With respect to the pearls of the river Conwy, it is reported that Sir Richard Wynne, of Gwydir, presented one to the queen of Charles the Second, which was afterwards placed in the regal crown. An Irish pearl is mentioned by Sir Robert Redding, in the Philoso-

phical Transactions, which weighed thirty-six carats, and was valued at forty pounds.

OF THE SOLEN OR RAZOR-SHELL TRIBE*.

These animals in general reside in holes, which they form in the sand at the bottom of the ocean. Their position in these holes is always upright. In situations where they are exposed to the air by the ebbing of the tide, their place is easily known to fishermen, by a small dimple which they leave on the surface. Some of the species live in stone. Nearly all of them are used as food.

THE COMMON† AND THE SCABBARD RAZOR-SHELL‡.

Many of the bivalved shell-fishes have the powers of progressive or retrograde motion, by an instrument that has some resemblance to a leg or foot, and called the *tongue*. But these animals can, at pleasure, make this tongue assume almost every form which their exigencies require.

Like all the other species of Razor-shells, they are in-

* The shell is oblong, and open at both ends. Its hinge is furnished with a sharp, reflected tooth, not inserted into any groove in the opposite valve. The animal is an *Ascidia*.

† DESCRIPTION. This shell is seven or eight inches broad, and one inch deep. It is linear, and straight; and one of the hinges is two-toothed. The colour is olive-brown, with a conoid ash-coloured mark dividing the shells diagonally. One part is striate longitudinally, and the other transversely.

SYNONYMS. *Solen Siliqua*. Linn.—*Solen Silique*. Bosc.

‡ DESCRIPTION. This species is not quite so large as the last. It is linear, straight, roundish, and margined at one end. The hinge has a single tooth in each valve. Its general colour is yellowish.

SYNONYMS. *Solen vagina*. Linn.—*Le Fourreau*. Cuvier.
—*Solen Manche de Couteau*. Bosc.

capable of progressive motion on the surface; but they dig a hole or cell in the sand, sometimes two feet in depth, in which they can ascend or descend at pleasure. The instrument by which their motions are performed, is fleshy, cylindrical, and situated near the centre of their body. When necessary, the animals can make the termination of the tongue assume the form of a ball. The Razor-fish, when lying on the surface of the sand, and about to sink into it, extends its tongue from the inferior end of the shell, and makes the extremity of it take the form of a shovel, sharp on each side, and terminating in a point. With this instrument the animal cuts a hole in the sand. After the hole is made, it advances the tongue still further into the sand, makes it assume the form of a hook; and with this hook, as a fulcrum, it obliges the shell to descend into the hole. In this manner the animal operates until the shell totally disappears. When it chooses to regain the surface, it forms the termination of the tongue into the shape of a ball, and makes an effort to extend the whole tongue; but the ball prevents any further descent, and the muscular effort necessarily pushes the shell upward, until it reaches the surface. It is amazing with what quickness and dexterity these seemingly awkward motions are performed.

It is remarkable, that the Razor-fish, though it lives in salt water, seems to abhor salt. When a little salt is thrown into the hole, the animal instantly quits its habitation. But it is still more remarkable, that, if the animal be once seized with the hand, and afterwards allowed to retire into its cell, salt will then be strewed in vain, for the fish will never again make its appearance. If it be not handled, the animal, by an application of salt, may be made to come to the surface as often as a person pleases; and fishermen sometimes make use of this stratagem as a means of catching it.

These shells are not uncommon on most of our sandy shores.

OF THE CARDIUM OR COCKLE TRIBE*.

On sandy shores of almost all the known seas, some of the species of Cockle are to be observed. Most of them are found immersed in the sand, at the depth of a few inches. Their size is various, from five or six inches to half an inch in diameter. In a fossil state these shells are by no means uncommon; and species corresponding with some of them inhabit the Indian ocean.

THE COMMON COCKLE†.

All the loco-motive powers of these well-known animals are concentrated in the triangular yellow foot, which is so conspicuous when we open the shells. This foot is not only capable of great inflexion, but also of seizing with its point the glutinous matter which proceeds from it, drawing this into threads, and thereby, in some measure, securing the animals within the sand which they inhabit.

Few of our shell-fish are more common, in inlets and bays near the mouths of rivers, than these. In such situations they are usually found immersed at the depth of two or three inches in the sand, the place of each being marked by a small, circular, depressed spot.

When they open their shells, the entrance into these is protected by a soft membrane, which entirely closes up the front, except in two places, at each of which there is a small, yellow, and fringed tube. By means of these tubes it is that the animals receive and eject the

* The shell is bivalve, equivalve, convex, and in most of the species, longitudinally ribbed. The hinge has two teeth near the beak, and a larger one placed remote on each side, locking into the opposite valve. The animal is a *Tethys*.

† SYNONYMS. *Cardium edule*. *Linnaeus*.—*Bucarde* *sourdon*. *Bosc*.—*Le Coque*. *Cuvier*.

water which conveys to their body the nutriment necessary for their support.

Cockles are in great request as food, and are caught for this purpose chiefly during the winter months. In places where they are not very numerous, they are picked up separately: but where they are sufficiently abundant, they are dug out of the sand, put into osier-baskets, and then soused into the water, for the purpose of clearing them of such sand as has been dug up along with them.

OF THE OYSTER TRIBE*.

There are few tribes of shell-fish more numerous or more generally dispersed over submarine rocks and sands, in all parts of the world, than these. The greater number of them are wholesome and extremely palatable food.

From a similarity in the structure of the hinge, the Oysters and Scallops have been united into one tribe. But they differ very essentially, both in their habits and external appearance. The Oysters adhere to rocks, or, as in two or three species, to roots of trees on the shore; while the Scallops are always detached, and usually lurk in the sand.

THE COMMON OYSTER†, AND GREAT SCALLOP‡.

It is the nature of Oysters in general to have their lower valve fixed to rocks or loose stones, and frequently even to each other. Some of them, however,

* Oysters are bivalve shell-fish, having the valves generally unequal. The hinge is without teeth, but furnished with a somewhat oval cavity, and mostly with lateral transverse grooves.

† SYNONYMS. *Ostrea edulis*. *Linn.*—Huître commune. *Bosc.* *Cuvier*.

‡ SYNONYMS. *Ostrea maxima*. *Linn.*—Pecten Maximus. *Montagu.*—Peigne Gigantesque. *Cuvier*.

are loose; these have very thin shells, and are more regularly shaped than the others.

Most of our rocky coasts produce Oysters in great abundance; but those chiefly celebrated for them are the coasts of Essex and Suffolk. Here they are dredged up by a kind of net, (with an iron scraper at the mouth,) which is dragged by a rope from a boat, over the beds. As soon as they are taken from their native beds, they are stored in pits formed for the purpose, and furnished with sluices; through which, at spring tides, the water is suffered to flow. This water, being stagnant, soon becomes green in warm weather, and after a few days the Oysters acquire the same tinge, which renders them of greater value in the market: but they do not acquire their full quality, and become fit for sale, till the end of six or eight weeks.

The principal breeding-time of Oysters is in the months of April and May, when they cast their spawn, or *spats*, as the fishermen call them, upon rocks, stones, shells, or any other hard substance that happens to be near the place where they lie; and to these the spats immediately adhere. Till they obtain their film or crust, they are somewhat like the drop of a candle, but are of a greenish hue. The substances to which they adhere, of whatever nature, are called *cultch*. From the spawning-time till about the end of July, the Oysters are said to be sick; but by the end of August they become perfectly recovered. During these months they are out of season, and are bad eating.

The Oyster-fishery of our principal coasts is regulated by a court of admiralty. In the month of May the fishermen are allowed to take the Oysters, in order to separate the spawn from the cultch, the latter of which is thrown in again, for the purpose of preserving the bed for the future. After this month it is felony to carry away the cultch, and otherwise punishable to take any Oyster, between whose shells, when closed, a shilling will rattle. The reason of the heavy penalty on destroying the cultch is, that when this is taken away, the ouse

will increase, and muscles and cockles will breed on the bed, and, by gradually occupying all the places on which the spawn should be cast, will destroy the Oysters.

Oysters are not reckoned proper for the table until they are about a year and a half old; so that the brood of one spring are not to be taken for sale till at least the September twelve months afterward. When younger ones than these happen to be caught in the dredge, they are always thrown into the sea again. The fishermen know the age of Oysters by the broader distances, or interstices, among the rounds or rings of the convex shell.

The Oysters in the pits, of course, always lie loose, but on their native beds they are in general fixed by their under shell; and their goodness is said to be materially affected, by their being laid in the pits, with the flat shell downward; not being able, in this position, to retain a sufficient quantity of water in the shell for fattening them.

The Oyster has been represented, by many authors, as an animal destitute not only of motion, but of every species of sensation. It is able, however, to perform movements which are perfectly consonant to its wants, to the dangers it apprehends, and to the enemies by which it is attacked. Instead of being destitute of sensation, Oysters are even capable of deriving some knowledge from experience. When removed from situations that are constantly covered with the sea, they open their shells, lose their water, and die in a few days. But, when taken from similar situations, and laid down in places from which the sea occasionally retires, they feel the effect of the sun's rays, or of the cold air, or perhaps apprehend the attacks of enemies, and accordingly learn to keep their shells close till the tide returns. Oysters breathe by means of gills. They draw the water in at their mouth, a small opening in the upper part of their body, drive it down a long canal that constitutes the base of the gills, and so out again, re-

taining the air that is requisite for the functions of the body.

The Great Scallop.—The Scallop has the power of progressive motion upon land, and likewise of swimming on the surface of the water. When this animal happens to be deserted by the tide, it opens its shell to the full extent, then shuts it with a sudden jerk, often rising five or six inches from the ground. In this manner it tumbles forward, until it regains the water. When the sea is calm, it is said that troops or little fleets of Scallops are sometimes to be observed swimming on the surface. They raise one valve of their shell above the surface, which becomes a kind of sail, while the other remains on the water, and, by steadying the animal, and thus preventing its being overset, answers the purpose of a keel. When an enemy approaches, these animals instantly close their shells, plunge to the bottom, and the whole fleet disappears. By what means they are enabled to regain the surface, we are totally ignorant.

Scallops are frequently sold for the table; and, in some parts of Europe, are much esteemed.

OF THE MUSCLES IN GENERAL*.

Some of the Muscles penetrate into the interior of calcareous rocks, where they reside out of the reach of danger. Others adhere by their beard to the exterior of rocks or stones; and so tenacious is their hold, that, in the larger species, they cannot be separated without considerable exertion. One species is gathered from the depths of the sea, on account of the *pearls* which are found within its shells.

* The Muscle tribe is distinguished by the shell being bivalve, without any tooth in the hinge, but in having the hinge marked with a longitudinal hollow line; and by the animal's being generally fixed to some substance by a byssus or silky beard.

THE COMMON OR EDIBLE MUSCLE*.

By the silky threads which it forms from its body, this species adheres to rocks, both in the European and Indian seas; but it grows to a much larger size between the Tropics, than in the northern climates. It abounds on the British shores, and is one of the commonest of our shells.

All the Muscles have, for an instrument of motion, a tongue or foot, capable of considerable elongation, and also of being shortened into the form of a heart. This is marked with a longitudinal furrow, and is completely enveloped in a sheath formed of transverse and circular fibres, of an obscure purple colour. When the animal is inclined to change its place, it thrusts the foot out of the shell, and raises itself on its edge; then, by extending this forward, it uses it as a kind of arm, drawing the body up to it, and thus it proceeds until it has found a convenient situation. If the Muscle be inclined to continue at the spot to which it has removed, the instrument of its motion is put to a very different employment; it is now employed in spinning those silky threads which fix it firmly to the spot, and which, like a ship at anchor, enable it to brave all the agitations of the water. All this it accomplishes by seizing with its point the gluten that is supplied by a gland situated under its base, and drawing it out, through the furrow, into threads. When the Muscle is thus fixed, it lives upon the little earthy particles, or upon the bodies of such smaller animals, as the water transports to its shells.

These Muscles are generally esteemed a rich and wholesome food; but to some constitutions they occasion disorders, the symptoms of which are great swellings, eruptions of blotches or pimples, shortness of breath, convulsive motions, and sometimes even deli-

* SYNONYMS. *Mytilus edulis*. Linn.—La Moule commune. Bosc. Cuvier.

rium. A remedy that has been recommended is two spoons-full of oil, and one of lemon-juice, (or about two of vinegar,) shaken well together, and swallowed as soon as any of the symptoms take place. This unwholesome quality has been attributed to a small species of crab, the *Cancer pisum* of Linnæus, that is sometimes found within the shells. It seems, however, not to have its seat in any thing essential to the Muscle; for, when illness of this kind has been occasioned, some persons have been affected, and others have not, who have eaten at the same time, and at least in equal quantity.

THE PEARL MUSCLE*.

The Pearl is a calculus or morbid concretion, which is produced not only in these, but sometimes even in the common oysters, muscles, and other shells. It is found both in the body of the animal, and within the shells, on the outside of the body.

The principal fishery for pearls is on the coast of Tinevely in Eastern Hindostan, where the natives find them of such commercial importance, as to employ in the fishery several hundreds of small vessels. The pearls are taken at two seasons of the year, in March and April, and again in August and September. They do not, however, fish every year; for if, upon trial, they do not find the pearls sufficiently valuable, they abstain until the ensuing season, in order to allow them time to increase their size.

* DESCRIPTION. The Pearl Muscle has a flattened and nearly circular shell, about eight inches long, and somewhat more in breadth. The colour of the exterior is very various, being in some individuals sea-green, in others chesnut, or even bloom colour, with white rays, and sometimes whitish, with green rays. The young shells resemble scallops, having ears as long as the shell.

SYNONYMS. *Mytilus Margariferens*. Linn.—La Moule Perle. *Bosc.*—La Moule du Rhin. *Unio Margaritifera*. *Cuvier*.

A cord is fastened under the arms of the divers, and held by the persons in the boat; and, to accelerate their descent, the divers have a perforated stone, of eighteen or twenty pounds weight, tied by a cord to their great toe. Each of them is also furnished with a sack, which has the mouth distended by a hoop. They then descend, and, on reaching the bottom, slip off the stone, which is drawn up, and fill their sack with shells. When this is full they give a signal, by pulling the rope, and they are then themselves drawn up by the men in the boats.

The depth of water in which this fishery is carried on, is twenty or thirty yards, and the distance from the shore four or five leagues. When the men are drawn up, they rest eight or ten minutes, to recover their breath, and then plunge in again; and a succession of men continue this slavish employment for ten or twelve hours every day. The shells are left in vast heaps to putrefy, until the season is over. The gains of the adventurers are often small, as the success is very precarious. Great pearls are seldom found, and the generality of what are taken, are of the smaller kind, called Seed Pearls, which are sold by the ounce, to be converted into powder.

The *shells* are found adhering to the coral banks. Numbers of sharks lurk about the diving-places, and often devour the poor adventurers.

OF THE PINNA TRIBE*.

Few tribes of shell-fish have been more celebrated, even from the remotest periods of antiquity, than these. They are usually found in the sand or mud, in an erect position, with their larger end a little open. In this po-

* This shell is a bivalve, fragile, upright, gaping at one end, and furnished with a silky byssus or beard. The hinge has no tooth; and the valves are connected on one side nearly through their whole length. The animal is an *Ascidia*.

sition they are firmly fixed, by means of a fine and strong byssus or silk, the fibres of which are agglutinated to the gravel, sand, roots of marine plants, broken shells, and other extraneous substances.

The animals of many of the species are used as food, and are in great request for the table.

THE SEA-WING*.

A bed of these shells was a few years ago discovered in Salcomb Bay, near Kingsbridge, Devonshire, by Col. Montagu, who has given us a very interesting account of them. He states, that they inhabit a gravelly bottom, covered with mud and long sea-weeds, and are only to be approached at particular times, when the sea recedes further than usual.

They stand upright, with their broad end about an inch above the surface, and the lower end fixed by a large and strong byssus, which is so firmly attached to the gravel, that it requires some force to draw them up; and, even when dragged out, the byssus is usually left behind. This beard is composed of numerous fine, silk-like fibres, of a dark purplish brown colour, and two or three inches in length.

Many of these shells are caught annually, the animals being accounted a very palatable food; but they require at least five or six hours stewing, in order to render them eatable; if this be properly attended to, they are nearly as good as Scallops, but they are never so tender.

* DESCRIPTION. These shells are of all sizes, from an inch to a foot in length. They are rugged, with irregular concentric wrinkles running lengthways from the beak, at the open side, and turning to the hinge, nearly at right angles; sometimes breaking into laminæ or plates. The large old shells are of an opaque horn-colour: the small ones are paler, and more diaphanous: all are, more or less, of a changeable green colour, at the bottom of the shell. The valves are connected through their whole length. *Montagu.*

SYNONYM. *Pinna ingens. Penn. Montagu.*

The bank, near Kingsbridge, on which these shells are found, probably increases, so that the water leaves a greater portion of it exposed at every spring tide, than formerly: and, in consequence, great numbers of the animals become an easy prey to crows and gulls.

According to Aristotle, the byssus of the ancients was the beard of one of the species of Pinna; but the name seems to have been used indiscriminately by other writers, for any spun material that was esteemed finer or more valuable than wool. Reaumur remarks that the threads of the byssus are as fine and beautiful as silk. The Pinna on the coasts of Italy and Provence, (where it is fished up by means of iron hooks fixed on long poles,) is called the silk-worm of the sea. The stockings and gloves that are manufactured from the byssus which is there collected, are of exquisite fineness, but are too warm for common wear.

The Pinna, observes Col. Montagu, has long been celebrated for giving protection to a small species of crab, which was supposed to be of use to it, by giving it notice either of approaching danger, or of the presence of its prey. Respecting this circumstance, many stories have been handed down to us from the earliest times. These, although not wholly unfounded, are mixed with too much fable to be fully credited in this enlightened age.



Univalves.

OF THE ARGONAUTS IN GENERAL.

The animals of the Argonaut tribe, have a near alliance to the Sepiæ or Cuttle-fishes. The shells are spiral, involute, of a white substance, and so thin, as almost to resemble paper. They have each only a single cell, and are not to be confounded with the Chambered

or Pearly Nautili, which belong to a different class, and bear very little resemblance to the shells of the present, either in their structure or habits.

THE PAPER NAUTILUS, OR ARGONAUT *.

This was the famous *Nautilus* of the ancients ; and, in the early ages of society, it is supposed to have furnished the original idea of navigation. When this little animal means to sail, it discharges a quantity of water from its shell, by which it is rendered lighter than the surrounding medium, and of course rises to the surface. Here it extends two of its arms upward. These are each furnished at their extremity with an oval membrane, which serves as a sail. The other six arms hang over the sides of the shell, and supply the place of oars and rudder. Oppian, speaking of these animals, says,

Two feet they upward raise, and steady keep ;
These are the masts and rigging of the ship.
A membrane stretch'd between supplies the sail,
Bends from the masts, and swells before the gale.
The other feet hang paddling on each side,
And serve for oars to row, and helm to guide.
'Tis thus they sail, pleased with the wanton game,
The fish, the sailor, and the ship the same.
But, when the swimmers dread some danger near,
The sportive pleasure yields to stronger fear :
No more they wanton drive before the blasts,
But strike the sails, and bring down all the masts.
The rolling waves their sinking shells o'erflow,
And dash them down again to sands below.

In some places, when the sea is not agitated by winds, great numbers of these singular creatures may occasion-

* DESCRIPTION. This shell is six or eight inches in length, of a white or yellowish colour, and but little thicker than paper. It is compressed at the sides, and has a double row of tubercles. The keel or ridge of the shell is slightly toothed on each side.

SYNONYMS. Argonauta Argo. *Linnaeus*.—Argonauta Papyracé. *Bosc*.

ally be seen diverting themselves by sailing about in this manner; but as soon as a storm arises, or any thing gives them disturbance, they retract their arms, take in as much water as, with the weight of their body, renders them heavier than the medium in which they swim, and sink to the bottom. Several of these animals were observed by M. Le Vaillant, on the sea near the Cape of Good Hope; and, as he was desirous of obtaining perfect specimens of the shells, he sent some of his people into the water to catch them: but, when the men had nearly approached them with their hands, the animals always sank; and, notwithstanding every art they could employ, they were not able to obtain a single one. The instinct of the animal showed itself superior to all their subtlety; and, when their disappointed master called the men away from their attempts, they expressed themselves not a little chagrined at being outwitted by a shell-fish.

These animals are found in the Mediterranean, the Indian Ocean, and in the neighbourhood of the Cape of Good Hope.

OF THE CYPRÆAS, OR COWRIES*.

There is no tribe of shells which, on the whole, are more beautiful than these. From their high polish and brilliant colours, they have derived the name by which they are most commonly known in France, of *Porcelaines*. The species are very numerous. In uncivilized countries, several of them are worn as ornaments, both by men and women; and some of them are worn as amulets or charms against disease.

They reside in the sand at the bottom of the sea, and are furnished with a membrane, which is so extensive,

* These shells are univalve, involuted, of a somewhat ovate shape, obtuse, and smooth. The aperture is linear, extended through the whole length of the shell, and dentated on both sides. The animal is a *Limax*, or Slug.

that they are able to throw it over their whole shells, and thus to preserve them always pure and polished. These animals have two horns; and the canal by which they respire, is situated on the top of their head.

THE TIGER* AND MONEY COWRY†.

There are few shells of the present tribe more common in collections, and at the same time more beautiful, than the former of these species. It is found both in the Indian and Adriatic Seas. The latter are well known on almost all the coasts of Africa and India, where they are employed by the natives in commerce, instead of money, about two thousand of them being esteemed equal in value to a rupee. The negro women, it is stated, fish for them usually three days before or after the full moon; and, at the Maldivian Islands, thirty or forty vessels are annually laden with them, for exportation into Africa, Bengal, Siam, and other countries, for the purposes of commerce.

Of the Cowries, a very remarkable fact has been stated by M. Bruguière, that when the animals find their shells too small for the increased dimension of their body, they quit them, and proceed to the formation of new ones of larger size, and consequently better adapted to their wants.

* **DESCRIPTION.** The Tiger Cowry is usually about four inches and a half long; of an ovate shape, obtuse behind, and rounded before. It is highly polished, of a ferruginous colour, with dark brown spots, and a yellowish longitudinal line along the back. It has sometimes a yellowish or bluish gloss. The under part is white.

SYNONYMS. *Cypræa Tigris.* Linnæus.—Porcelaine Tigre. Bosc.—Le Tigre. Cuvier.

† **DESCRIPTION.** This species is about three quarters of an inch in length, is of a whitish colour, and has a knotted margin.

SYNONYMS. *Cypræa Moneta.* Linn.—Porcelaine Monnoie. Bosc.—Le Cauris. Cuvier.

As soon as the Cowry has abandoned its covering, the hinder parts of its body begin to furnish anew the testaceous matter, which is afterwards condensed upon its surface. This secretion is continued, until at length the shell appears of the consistence of paper: and the mouth or opening of the shell, which at this period is very wide, soon afterwards contracts to its proper form and dimension. The edges are thickened, and formed into those beautiful folds or teeth, which are so remarkable on each side of the opening of these shells; and by means of the membranaceous wings of the animals, the highly polished surface of the whole exterior of the shells is by degrees completed.

OF THE BUCCINUM OR WHELK TRIBE*.

The situations in which the animals of the present tribe are chiefly found, are submarine rocks, stones, and weeds. To these they adhere so firmly, as not easily to be loosened, either by the waves or the currents of the ocean. A few of them are of large size. Their shells are peculiarly thick and strong: and some of the larger kinds were anciently employed as trumpets, by the sound of which armies were summoned to battle.

THE PURPLE-STAINING WHELK†.

In ancient times, these animals, or some others of the present tribe, were very valued on the coasts of the

* The shell is univalve, spiral, and gibbous. The aperture is round, and ends in a short canal or process, which bends to the right. The animal is a *Limax*, or Slug.

† DESCRIPTION. The length of this shell is generally from an inch to an inch and a half. It is of an oval shape, acute, and spirally striated, without protuberances: the pillar is flattish. It varies in colour, being white, cinereous, or yellowish, and sometimes being transversely barred.

SYNONYMS. *Buccinum lapillus*. *Lin.*—*Buccin teinturier*. *Rou.*

Mediterranean, on account of a valuable purple dye which was extracted from them. They have, however, of late been entirely neglected, in consequence of the discovery of cochineal, from which a dye equally excellent, and at much less cost, is procured. The number of these shells necessary to have been collected together for the purpose of dying even a small quantity of cloth, must have been very great. The dying matter, like the ink in the Cuttle-fish, is found in a peculiar reservoir, situated in the upper part of the body, and on one side of the stomach. The reservoir is very small, being seldom so large as a small pea.

The natives of South America, who employ the juice of these animals in dying, extract it in two ways. They sometimes break the shell, and, taking out the animal, lay it on the back of one of their hands: with a knife they press the juice from the head towards the tail, then, separating the part of the body into which it is collected, throw the rest away. The usual mode, however, is not to break the shell, but only to squeeze the animal until it throws up the juice; they then return the animal to the rocks, where it soon recovers from its bruises.

When the juice is first extracted, it is of a greenish colour, and viscous consistency, and in smell is not unlike garlic or assafoetida. This juice does not assume a purple tint, until it has been some time exposed to the action of the sun and air. It is then so indelible, as to bid defiance to any known chemical process to extract it. In a handkerchief, the corner of which I stained with it, the colour was retained with undiminished brilliancy for several years.

These animals adhere to rocks and stones, and feed on the smaller kinds of marine worms, which they suck by means of a tubular proboscis, situated beneath the head. They are able to close the aperture of their shells, and thus to secure themselves from the attack of all the smaller animals of the deep: this is done by means of a thin horny cover or *operculum*, which is attached to their body, and is exactly the size of the opening.

OF THE HELICES OR SNAILS IN GENERAL.

The All-wise Author of Nature has denied to these animals the use of feet and claws, to enable them to move from place to place; but he has made them ample amends, in a way more commodious to their habits and mode of life, by a broad skin along each side of the belly, and the power of motion which this skin possesses. By this motion they are enabled to creep, and by the skin, assisted by the glutinous slime emitted from their body, they adhere securely even to the smoothest surfaces.

When the snail is in motion, four horns are distinctly seen on its head; but the two uppermost and longest of these deserve peculiar consideration, both on account of the various motions with which they are endued, and also from their having eyes at their summits. These eyes appear like two blackish points, and when taken from the body are of a bulbous figure. They have but one coat; and the vitreous, the aqueous, and the crystalline humours, may be discovered in them. Snails are able to direct these eyes towards different objects at pleasure, by a regular motion out of the body; and sometimes they hide them, by a very swift contraction into the belly. Under the smaller horns, is the animal's mouth; and, though the substance of this may appear too soft to be furnished with teeth, yet it has no fewer than eight. With these it chews leaves and other substances, seemingly harder than any part of its own body; and with them it sometimes bites off even pieces of its own shell.

From various experiments that have been made on snails, it appears that they are possessed of considerable powers of reproduction. Spallanzani found that their heads might be cut off, and that, in a certain time, other heads would be formed.

THE GARDEN-SNAIL*, HEDGE-SNAIL†, AND GROVE-SNAIL‡.

See to the fight the gentle warriors move,
And dart, with harmless force, the shafts of love!

The mode of breeding, in this and a few other species of snails, is extremely curious. At a certain time of the year they meet in pairs, and stationing themselves an inch or two apart, they launch at each other several little darts, not quite half an inch long. These are of a horny substance, and sharply pointed at one end. The animals, during the breeding season, are furnished with a little reservoir for them, situated in the neck, and opening on the right side. After the discharge of the first dart, the wounded snail immediately retaliates on its aggressor by ejecting at it a similar one: the other renews the battle, and in turn is again wounded. Thus are the darts of Cupid, metaphorical with all the rest of the creation, completely realized in snails. After the combat, they come together. Each of them

* DESCRIPTION. The Garden-snail is generally of a yellowish colour, with four tawny bands, interrupted by white spots. The lip is white. The whorls are rounded; and the shell is imperforate.

SYNONYMS. *Helix hortensis*. Linn.—*Hélice des Jardins*. Bosc.

† DESCRIPTION. This species is of a nearly globular shape, somewhat pellucid, and banded with various colours. The aperture is broader than it is long. The whorls are rounded; and, as in the last, the shell is imperforate.

SYNONYMS. *Helix nemoralis*. Linn.—*La Livrée*. Cuvier. Bosc.

* DESCRIPTION. The Grove-snail is mottled with gray, brown, yellowish, and chesnut. It is convex and pointed. The aperture is nearly circular, with a reflected margin, elongated on the fore part. The whorls are rounded, and the shell is slightly umbilicate.

SYNONYMS. *Helix arbustorum*. Linn.—*Hélice des Arbustes*. Tigny.

lays its eggs in some sheltered and moist situation, generally under a little clod of earth, or in some cool cavity. The eggs are about the size of small peas, semi-transparent, and of a soft substance. From these the young ones are hatched completely formed, with shells on their backs; and they undergo no further change than what necessarily takes place in the gradual increase of their size.

The depredations which these animals commit in gardens and orchards are very considerable; and it is remarkable, that in defect of moist and succulent food, such as fruit and tender leaves, they will attack even substances of a dry and hard nature. A Common Garden-snail, when confined for a single night, under a glass more than four inches in diameter, and placed on a sheet of common blue paper, has been known to devour the whole paper contained within the included space, to the very edge of the glass, so that a circular piece seemed almost as neatly taken out, as if it had been marked by a pair of compasses.

The Snail, if its shell be broken, has a power of mending it. Even when apparently crushed to pieces, these animals will set to work; and, with the slimy substance which they force from their bodies, and which soon hardens, they in a few days close up all the numerous chasms. The junctures, however, are easily distinguishable; and the whole shell, in some measure, resembles an old coat patched with new pieces. But, although the animal has the power of repairing its shell, it is not able to form a new one. Swammerdam tried the experiment. He stripped a snail of its shell, without injuring any of the blood-vessels; but it died in three days after it had lost its covering: not, however, without having made efforts to restore it, for, before its death, it pressed out a certain membrane round the whole surface of its body. This membrane was entirely of the shelly nature, and was intended, no doubt, as a supply towards a new one.

The following instances of tenacity of life in snails,

are well authenticated, and are probably without parallel in any other individuals of the animal creation.

Mr. Stuckey Simon, a merchant of Dublin, whose father, a fellow of the Royal Society, and a lover of natural history, left him a small collection of fossils and other curiosities, had, among them, the shells of some snails. About *fifteen years* after his father's death, (in whose possession they had continued many years,) he gave to his son, a child about ten years old, some of these snail-shells to play with. The boy placed them in a flower-pot, which he filled with water, and the next day he put them into a basin. Having occasion to use this, Mr. Simon observed that the animals had come out of their shells. He examined the child respecting them; and was assured that they were the same which had been in the cabinet. The boy said he had a few more, and brought them. Mr. S. put one of these into water, and in an hour and a half afterwards, he observed that it had put out its horns and body, which it moved but slowly, probably from weakness. Major Vallancy, Dr. Span, and other gentlemen, were afterwards present, and saw one of the snails crawl out, the remainder being dead, probably from their having remained some days in the water.

This shell was sent to Sir John Pringle, who exhibited it at a meeting of the Royal Society; but some of the members imagining that Mr. Simon must have been imposed upon, by his son having substituted fresh shells for those that had been given to him, the boy was examined by Dr. Macbride on the subject; and the Doctor declared that he could find no reason to believe that the child either did or could impose upon his father. Mr. Simons living in the heart of the city, rendered it almost impossible for the boy (if he had been so disposed) to collect fresh shells; for he was at that time confined to the house with a cold. Mr. Simon, moreover, declared, that he was positive those were the shells he gave to him, for he had in his cabinet many more of the same sort, and nearly of the same size.

After this account had been made public, there appeared in the Annual Register the following very singular narration. It was sent to the editors by a Mr. Rowe, and is stated to have been written by a lady, whose name he was not at liberty to mention.

"I was at Mr. Haddock's, at Wrotham in Kent, and was making a little shell-work tower, to stand on a cabinet in a long gallery. After having repaired two small amber temples to grace the corners, I was desirous of having some ornament for the front; and sea-shells running short before I had finished, I recollected having seen some pretty little snails on the chalk-hills there: we consequently all went one evening to pick up some. On our return I procured a large china-basin, and putting a handful or two of shells into it, filled it up with boiling water. I poured off the first water, and filled the bowl again. I then carried it into a summer-house in the garden, where I loved to work early in the morning, before my friends were stirring. Next morning, how great was my surprise, on entering the summer-house, to find my poor snails crawling about, some on the edge of the basin, some tumbling over, some on the table, and one or two actually eating the paste that was to stick them on! I was perfectly shocked, burst into tears, and carefully picking up every snail, carried them into a field beyond the garden, where I make no doubt they perfectly recovered from their scalding."

THE ESCULENT SNAIL*.

This is the largest of all the land-snails that are produced in this country. It is found in woods and under hedges, in Northamptonshire and some other southern counties.

* DESCRIPTION. This species is sometimes more than two inches in diameter. It is of nearly globular shape; and of a brownish white colour, with usually three reddish bands round

At the commencement of winter, it carefully closes its shell with a thick white cover or operculum, attached to its body, that just fills up the opening, and in this enclosed state, it remains until the commencement of warm weather, seldom appearing abroad till about the beginning of April.

It is large and fleshy, and, when properly cooked, is not unpleasant to the taste. Among the Romans it constituted a favourite dish; but, if the account of Varro is to be credited, they had it of a size infinitely larger than any now known; for this writer assures us, that the shells of some of them would hold ten quarts. The Romans kept these animals in what were called *Cochlearia*, or Snail-stews. These were generally formed under rocks or eminences, the bottoms of which were watered by lakes or rivers; and, if a natural dew or moisture was not found, an artificial one was formed, by bringing into the place a pipe bored full of holes, like a watering-pot, through which it was continually sprinkled. The snails required little attendance or food, supplying themselves, in a great measure, as they crawled about the sides or floor of their habitation. To fatten them, however, they were fed with bran and sodden lees of wine.

These snails are at this day much admired in some parts of the Continent, and are not always used from economical motives; for at Vienna, but a few years ago, seven of them were charged the same price in the inns, as a plate of veal or beef. The usual modes of preparing them for the table, are by boiling, frying them in butter, or sometimes stuffing them with force-meat: but, in what manner soever they are dressed, their sliminess always remains. The greatest numbers, and

the larger whorl. The aperture is large, somewhat lunate, and has the margin thickened and reflected. The pillar-lip is reflected. The whorls are rounded; and it is umbilicate.

SYNONYMS. *Helix pomatia*. Linn.—*Hélice des Vignes*, ou Escargot. Bosc.—*Le Grand Colimaçon des Vignes*. Cuvier.

the finest snails, are brought from Suabia. Dr. Browne, who travelled to Vienna somewhat more than a century ago, remarks, that since the markets were so well supplied with other provisions, "he was surprised to meet with some odd dishes at their tables, such as guinea-pigs, and divers sorts of snails and tortoises."

Dr. Townson was shown at Erlau, a snailery, which, the proprietor informed him, was constructed on an improved plan. In our island, he says, this might have had the denomination of a *Patent Snailery*, or *Philosophical Snail-sty*. It consisted only of a large hole, two or three feet deep, dug in the ground, having a wooden house as a cover. The animals were fed on the refuse of the garden, which was thrown to them.

There seems some doubt as to the original introduction of these snails into England. Mr. Pennant says, that we are indebted for them to Sir Kenelm Digby; and Da Costa, that, in the last century, a Charles Howard, Esq. of the Arundel family, brought some of them from Italy, in the hope of rendering them an article of food in England; and, for this purpose, dispersed them about the woods and downs of Albury, an ancient seat of that family, near Boxhill in Surrey. They are now to be found in considerable numbers, not only there, but also in several parts of the confines of Sussex.

Zoophytes*.

OF THE MADREPORES IN GENERAL†.

The great variety of Madrepores, their conspicuous appearance in the water, and their astonishing quantity on some coasts, have caused them to be remarked by navigators and travellers, from the earliest periods. They are all composed of calcareous matter, united with a portion of animal substance. By calcination they yield an excellent lime.

In certain species, their substance is extremely hard and solid; and in others, cellular and friable. Their form also varies much. Some are spherical, others semi-globose, and others flat: many are branched; and the branches of some are smooth, and of others hairy, furrowed, or striated. With respect to colour, they are red, yellow, brown, &c. but their most prevalent colour is yellowish white.

It is principally in hot climates, betwixt the Tropics,

* The creatures that are ranked under the Linnean order *Zoophyta*, seem to hold a middle station between animals and vegetables. Most of them, deprived altogether of the powers of loco-motion, are fixed by stems that take root in crevices of rocks, among sand, or in such other situations as nature has destined for their abode: these, by degrees, send off branches, till at length some of them attain the size and extent of large shrubs. The Zoophytes are usually considered under two divisions. The stony branches of the first division, which has the general appellation of *Coral*, are hollow, and full of cells, which are the habitations of animals resembling Polypes, Medusæ, &c. according to their respective genera. The next division consists of such animals as have softer stems, and are, in general, not merely inhabitants of a stem or branches, but are themselves in the form of a plant. Those of this division which are best known, are the Corallines, the Sponges, and the Polypes.

† The animals which inhabit the Madrepores are Medusæ. The coral which contains them is fixed and simple, or branched, with cavities composed of lamella in a star-like form.

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that they are in greatest abundance. Few of them have been observed in any of the European seas, except the Mediterranean. Many species are found in a fossil state.

THE BRANCHING* AND PRICKLY MADREPORE†.

At the extremity of each branch of the former of these species there is a star, composed of about seventeen rays or laminæ, which issue from the centre. The animals which inhabit these stars have their head in the centre, and are furnished with about eight feathery tentacula, by means of which they are enabled to seize their prey. When undisturbed, they protrude themselves from their cases, and oscillate from right to left, and from left to right, for a considerable while together, with an extremely quick motion. On any alarm, they immediately withdraw, and nothing is seen but the naked stem and branches.

In all their parts these little creatures are very tender and delicate. Their bodies are nearly transparent, and are marked with beautiful colours. This species is found in the Indian, the Mediterranean, and Atlantic seas; and, in its whole stem and branches, is sometimes twenty inches, or two feet high.

The Prickly Madrepora.—In some of the southern

* DESCRIPTION. This species, which grows to the height of two feet and upwards, is branched, and has distinct stars. The branches are striated, nearly pinnate, cylindrical, and truncate; the stars are at the extremities.

SYNONYMS. *Madrepora ramea*. *Linn.*—*Madrépore ramé*. *Tigny.*—*Le Porite branchu*. *Cuvier*.

† DESCRIPTION. The Prickly Madrepora, like the last species, is branched, and has distinct stars. It is composite, and subimbricate, with obliquely truncate, prominent, and ascending stars.

SYNONYMS. *Madrepora muricata*. *Linnaeus.*—*Madrépore Murique*. *Bosc*.

climates, this Madrepora is in such extraordinary abundance, as occasionally to form immense beds at the bottom of the sea. In height it increases, without limit, until it is arrested by the line of low water; and in width it is boundless. Captain Cook, and other navigators, have spoken of banks or reefs of coral, or Madrepora, so extensive as to have prevented their approach to land, sometimes even for several leagues. Many voyagers have mentioned the dangers to which they have been exposed, during stormy weather, upon these reefs, not only from their liability to be wrecked, by the ships driving against such as rose nearly to the surface of the water, but also from the cables to which their anchors were fixed having been cut in pieces by chafing against them.

There can be no doubt that several kinds of Madrepora concur in the formation of these reefs; but that which, in general, constitutes by far the greatest portion, is the species here mentioned.

OF THE CORAL TRIBE.

All the different species of coral are branched, and the branches are not articulated. Their interior is stony and solid. The surface is striated, and covered by a bark-like envelope, which is fleshy and porous; and from which there issue numerous animals, resembling polypes both in appearance and structure.

THE RED CORAL*.

Few persons are unacquainted with this production,

*DESCRIPTION. The branches are stony, red, cylindrical, tapering, and expanded. The flesh is red, soft, slimy, and full of minute pores. The pores or florets on the branches are irregularly situated, somewhat prominent, and consist of eight valves, from which the polypes proceed.

SYNONYMS. *Corallium nobilis*. Cuvier.—*Gorgonia nobi-*

at least in a wrought state, as forming necklaces or bracelets, for the ornament of the female figure. It is, perhaps, the most valuable of all the productions of the sea, except pearls; and constitutes a very important article of commerce.

Its general appearance is that of a shrub deprived of leaves, the stem being sometimes from three to six inches in diameter, and its whole height being usually from three to four feet. The interior, both of the stem and branches, is equal to marble in hardness. The polypes which issue from the branches are white, soft, and semi-transparent. Their tentacula are eight in number, equal in length, and fortified with several conical appendages. The mouth is situated in the centre of the tentacula; and below this is the stomach. The animals are no further connected to their cells, than by a very slender ligament.

When Coral is taken from the water, or even touched whilst under water, all the polypes suddenly contract. In this operation the appendices of the tentacula close within themselves, like the horns of snails; afterwards each tentaculum is folded towards the middle, the mouths then close, and the animals are completely concealed.

Donati observed, near the bottom of these polypes, several small, yellowish bodies, which proved to be the offspring or eggs. These, as soon as they were detached, fixed themselves firmly to those bodies on which they happened to fall. Here they extended their base, and, when the foetus was perfected, it opened, and a polype issued from the orifice. This has a small horn at its base: after a while, another springs from the side; then a third; and, lastly, a tree of Coral ascends.

The fishing for Coral is, at this day, an object of great importance to the inhabitants of Marseilles, Cata-

lis. *Linn. Gmel.*—*Isis nobilis. Linn. Syst. Nat.*—*Corail rouge. Bosc.*

lonia, and Corsica ; and the principal parts of the Mediterranean from which coral is obtained, are the coasts of Tunis and Sardinia, and the mouth of the Adriatic. The fishers employ, for this purpose, a very simple kind of machine, consisting of two strong bars of iron or wood tied across each other. From the centre of union of these they hang a weight. Each of the arms is loosely surrounded through its whole length with twisted hemp ; and at the extremity there is a small open purse or net. To use this machine, it is suspended by a rope, and dragged along those rocks where the Coral is most abundant. A considerable part of the Coral which is broken off, either becomes entangled in the hemp, or falls into the nets. This operation is usually carried on in places where the water is from eight to ten fathoms deep.

The most valuable Coral, however, as being the largest in size, and most compact in substance, is that which is brought from the East.

OF THE SPONGES IN GENERAL.

The Sponges consist of an entirely ramified mass of capillary tubes, supposed, by many persons, to be the production of a species of worms which are often found straying about the cavities. Others have imagined them vegetables. But that they are possessed of a living principle seems evident, from their alternately contracting and dilating their pores ; and shrinking, in some degree, from the touch, when examined in the water. They are capable of absorbing nutriment from the fluid in which they subsist. The species differ much from each other, both in shape and structure. Some are composed of reticulated fibres, or masses, of small spines : some, as the common or officinal Sponge, are of no regular shape ; others are cup-shaped, and others tubular.

THE OFFICIAL* AND DOWNY SPONGE†.

The Official Sponge is well known, from its utility for various domestic purposes. It is an elastic substance, and in every part is full of holes. It grows into irregular lobes of a woolly consistence, and generally adheres, by a broad base, to the rocks. A variety of small marine animals pierce and gnaw into its irregular winding cavities. These appear on the outside, by large holes, raised higher than the rest. When Sponge is cut perpendicularly, the interior parts are seen to consist of small tubes, which divide into branches as they appear on the surface. These tubes, which are composed of reticulated fibres, extend themselves every way; by this means increasing the surface of the Sponge, and ending at the outside in an infinite number of small holes, which are the proper mouths of the animal. Each of these holes is surrounded by a few erect pointed fibres, that appear as if they were woven in the form of little spines. The tubes, with their ramifications, in the living state of the Sponge, are clothed with a gelatinous substance, properly called the flesh of the animal.

Sponge is an object of commerce in the Mediterranean, and in several of the islands of the Grecian Archipelago. Here, on submarine rocks, it is found, of large size and in great abundance. As it is chiefly found on rocks, at

* DESCRIPTION. This well-known kind of Sponge is of irregular form, porous, tough, lobed, and woolly.

SYNONYMS. *Spongia officinalis*. Linn.—Eponge commune. Bosc.—L'Eponge des boutiques. Cuvier.

† DESCRIPTION. The tomentous Sponge is porous, of irregular form, brittle, soft, downy, and interwoven with extremely minute spines. When fresh it is of a bright orange-colour, and full of gelatinous flesh: when dry it is whitish, and very light.

SYNONYMS. *Spongia tomentosa*. Linn.—Eponge Velue. Bosc.

the depth of five or six fathoms, it has been the cause of many of the inhabitants of these islands having become excellent divers. Yet this fatiguing and dangerous employment does not at all enrich them; for M. Olivier, in his account of Greece, reports that they are in a state of the most lamentable poverty and wretchedness.

When first taken out of the sea, Sponges have a strong fishy smell, which the fishermen get rid of by washing them perfectly clean in fresh water. This is all the preparation which is necessary, previously to their being packed together for sale; but, without it, they would soon become putrid, and perish.

The reproduction of Sponge is more rapid than would, perhaps, be imagined: it is to be found, in perfection, in places from which, only two years before, it had been entirely cleared.

The *Downy Sponge* is a species very common on nearly all the coasts of Great Britain. It grows round the stalks of several kinds of sea-weeds; and is full of papillæ, or small protuberances. In each of these there is a hole, through which the sponge sucks in and squirts out sea-water, thus giving evident signs of life and motion. When viewed with the microscope, its surface appears composed of an infinite number of minute spiculæ, or prickles, which, if rubbed on the skin, will raise blisters. And it is stated, that this property is much increased if it be dried in an oven.

OF THE SERTULARIÆ, or VESICULAR CORALLINES.

The general appearance of all the species of Vesicular Corallines, is exceedingly delicate and beautiful. They have the form of plants, being fixed by a base to submarine rocks, to shells, sea-weeds, or other solid bodies, and usually branching upward in a peculiarly elegant manner. Their stems are composed of a horny or elas-

tic and semi-transparent substance, which does not effervesce with acids. These stems are tubulous, and beset throughout with numerous cup-shaped denticles, from which there issue little heads, in the form of polypes. In some of the species the polypes are on one side only of the branches; in others, on both sides; and in others they are verticillate. The colour varies; but the greatest number of them are either white, or of a transparent brown; and nearly all of them become brownish when dried.

The Vesicular Corallines form a very numerous tribe. They are common on all the coasts of Europe. By the ancient naturalists, they were considered to be vegetable productions; but they are now transferred to their proper place, in the animal kingdom.

Some of the species are oviparous, and others produce living offspring.

THE SEA-OAK SERTULARIA *.

Like all other polypes, the animals which inhabit the Sea-oak Sertularia subsist on marine animalcules, which they arrest, and conduct to their mouth, by means of their tentacula. This Sertularia is found on various species of fuci, or sea-weeds, but chiefly on that which is denominated by Linnæus *fucus serratus*.

On any alarm, the polypes immediately draw up and conceal themselves within their horny cells. They are sometimes luminous in the dark; for, if the leaf of the plant to which they adhere receive a smart stroke with a stick, the whole Sertularia will be most beautifully illuminated, every point from which a polype issues appearing as if on fire.

* DESCRIPTION. In this species the denticles bearing the polypes are opposite, pointed, and bend backward. The ovaries are obovate, and the branches irregular.

SYNONYMS. *Sertularia pumila*. Linn.—Sertulaire naine. Rosc.

The ovaries of these animals are small, ovate bladders, which adhere to the branches. When the young ones are discharged from the ovaries, they adhere, by their base, to the first object adapted to their wants on which they happen to fall. In this situation they quickly procure, with their tentacula, sufficient nourishment to increase their bulk. The stem soon begins to advance; and many more heads, with their tentacula, issue forth, and stretch themselves out, for the purpose of obtaining food. This causes a further increase of nourishment to be drawn in, which circulates through the whole animal, and enables it to send forth from its base creeping and adhering tubes, full of the same medullary substance with the rest of its body. These tubes secure it from the motion of the waves; and from them arise other young animals, or Sertulariæ, which, growing up like the former, with their proper heads or organs to procure food, send out adhering tubes from below; so that, in a short time, a whole grove of Sertulariæ is thus formed.

OF THE HYDRA OR POLYPE TRIBE.

Polypes are gelatinous animals, which consist of a long tubular body, fixed at the base, and surrounded at the mouth by arms or tentacula. They are chiefly inhabitants of fresh water, and are among the most wonderful productions of nature. The particulars of their life, their mode of propagation, and powers of reproduction, after being cut to pieces, are truly astonishing. Long after experiments had been made, did scepticism involve the philosophic world; and the history of the animals did not obtain complete credit, till these had not only been often repeated, but had been varied in every possible manner.

THE LONG-ARMED* AND GREEN POLYPE†.

These are two species which will fully illustrate the nature of the whole tribe. They are found in clear waters, and may generally be seen in small ditches and trenches of fields, especially in the months of April and May. They affix themselves to the under parts of leaves, and to the stalks of such vegetables as happen to grow immersed in the same water; and they feed on the various species of small worms, and other aquatic animals that happen to approach. When any animal of this kind passes near a Polype, the Polype suddenly catches it with its arms, and dragging it to its mouth, swallows it by degrees, much in the same manner as a snake swallows a frog. Two Polypes may occasionally be seen in the act of seizing the same worm at different ends, and dragging it, in opposite directions, with great force. It sometimes happens, that, while one is swallowing its respective end, the other is also employed in the same manner; and thus they continue swallowing, each his part, until their mouths meet. They then rest for some time in this situation, till the worm breaks between them, and each goes off with his share. But when the mouths of both are thus joined together upon one common prey, a more dangerous combat now and

* DESCRIPTION. The common, or Long-armed Polype is about an inch in length, of a yellowish-gray colour. It has usually around the mouth about seven tentacula, which are longer than the body. The general shape of the body is somewhat cylindrical, tapering towards the base.

SYNONYMS. *Hydra grisea*. Linn.—Hydre grise. Bosc.—L'Hydre à long bras, in France.

† DESCRIPTION. This species is of a green colour, and furnished usually with eight tentacula, which are shorter than the body. Like the preceding animal, it has the power of contracting its body, in a very sudden manner, when disturbed, so as to appear only like a small green or brownish lump.

SYNONYMS. *Hydra viridis*. Linn.—Hydre verte. Bosc. Cuvier.

then ensues. The largest Polype gapes and swallows his antagonist; but, what is extremely wonderful, the animal thus swallowed seems to be a gainer by the misfortune. After it has lain in the conqueror's body for about an hour, it issues unhurt, and often in possession of the prey that had been the original cause of contention. The remains of the animal on which the Polype feeds are evacuated at the mouth, the only opening in the body. The Polype is capable of swallowing a worm thrice its own size: this, though it may at first appear incredible, is easily understood, when we consider that the body of the Polype is extremely extensile, and is dilated on such occasions to a surprising degree.

The species are multiplied, for the most part, by a kind of vegetation, one or two, or even more young-ones, emerging gradually from the sides of the parent animal; and these young-ones are frequently again prolific before they drop off: so that it is no uncommon thing to see two or three generations at once on the same Polype.

But the most astonishing particular respecting this animal is, that, if a Polype be cut in pieces, it is not destroyed, but is multiplied by dissection: it is thus literally

Rich from its loss, and fruitful from its wound.

It may be cut in every direction that fancy can suggest, and even into very minute divisions, and not only the parent stock will remain uninjured, but every section will become an animal. Even when turned inside-out, it suffers no material injury; for, in this state, it will soon begin to take food, and to perform all its other natural functions.

M. Trembley, of Geneva, ascertained that different portions of one Polype could be engrafted on another. Two transverse sections brought into contact will quickly unite, and form one animal, though each section belong to a different species. The head of one

species may be engrafted on the body of another. When one Polype is introduced by the tail into another's body, the two heads unite, and form one individual. Pursuing these strange operations, M. Trembly gave scope to his fancy, and, by repeatedly splitting the head and part of the body, he formed hydras more complicated than ever struck the imagination of the most romantic fabulists.

These creatures continue active during the greatest part of the year, and it is only when the cold is most intense that they feel the general torpor of nature. All their faculties are then, for two or three months, suspended. But if they abstain at one time, they make ample amends in their voracity at another; and, like all those animals which become torpid in winter, the meal of one day suffices them for several months.

Animalcules*.

OF THE VORTICELLA TRIBE†.

The Vorticellæ, or Wheel Animals, are the most remarkable of all animalcules, not only in their structure, but also in their habits and production. In general form they bear great affinity to the polypes, having a contractile, naked body, furnished with rotatory organs round the mouth; and indeed many microscopical writers have denominated them *Cluster-polypes*.

* The animals of the Linnean order *Infusoria* are extremely simple in their form, and generally invisible without a magnifying power. They are chiefly found in infusions of animal and vegetable substances.

† In this tribe the animals have a contractile, naked body, furnished with ciliate, rotatory organs.

They are almost invisibly minute, and, during the summer months, are generally found in clear, stagnant waters, attached to the stalks of the lesser water-plants, where they feed on animalcules still smaller than themselves. Many of the species are found in groups, sometimes formed by the mere approximation of several individuals, and at other times by the ramified or aggregate manner in which they grow. Their various motions, like those of the polypes, are generally exerted only for the purpose of obtaining prey. The rotatory motion of their tentacula causes an eddy in the water, around each individual, sufficient to attract into its vortex such animalcules as happen to swim near; these the little creature seizes, by suddenly contracting its tentacula and enclosing them in the midst. In several of the species the stems, into which they occasionally withdraw themselves, are somewhat rigid or scaly. The young-ones are carried in oval integuments on the outside of the lower part of the stems; and, when ready to issue forth, the parents aid their extrusion, where such is necessary, by writhing their bodies, or striking the little vesicle. As soon as the young-one is liberated from its prison, it fixes itself, and commences the necessary operations to procure its food.

THE COMMON WHEEL ANIMALCULE*, AND THE
CONVALLARIAN VORTICELLA†.

If the water that is found standing in gutters of lead,

* DESCRIPTION. This very minute animal, which, to the naked eye, appears only like a yellowish dot, is of a somewhat cylindrical shape. It is furnished with a double rotatory organ; its tail is composed of about three retractile joints, and terminated by four minute hooks.

SYNONYMS. *Vorticella rotatoria*. Linn.—*Vorticelle rotifère*. Bosc.—*Le Rotifère de Spallanzani*. Cuvier.—*Wheel Animal*.

† DESCRIPTION. To the naked eye the Convallarian Vor-

or the sediment it has left behind, has any appearance of a red or dark brown colour, it will almost always be found to contain these animalcules. And, in the summer-time, if a small quantity of this dust be put into water, and placed under the microscope, it seldom fails to yield them in considerable numbers. They are denominated Wheel Animals, from their being furnished with a pair of instruments on the anterior part of their body, which, in figure and motion, somewhat resemble wheels.

These animalcules may be kept for several months out of water, and in a state of perfect dryness, without losing the principle of life. When dry, they are of a globular form, and about the size of a grain of sand. If put into water, after the space of about half an hour a languid motion begins. The globule turns itself about, lengthens by degrees, and soon afterwards becomes very lively. In a short time it protrudes its wheel, and swims about in search of food; or, fixing itself by the tail, brings the food to it by its rotatory organs, which throw the whole circumjacent fluid into a violent commotion. After its hunger is satisfied, it generally becomes quiescent; and sometimes resumes even its globular form.

During the time it is in action, it frequently changes its shape and appearance: this, and the sudden transformation of the head, are equally surprising and singular. From being very taper, the head sometimes becomes, almost instantaneously, as broad as any part of the body, and protrudes its curious machinery. The circular bodies projecting from the animal in this state, whirl round with considerable velocity. As they are very transparent, the edges excepted, which are set with numerous fibrillæ, it is difficult to distinguish how

ticella has the appearance of a white point. In the microscope it is seen to be bell-shaped, and not unlike the flower of the Lily of the Valley, each individual having a long retortile stem.

SYNONYMS. *Vorticella convallaria*. *Linnaeus*.—*Vorticelle muguet*. *Bosc*. *Cuvier*.

the rotatory motions are performed; or whether their figure be flat, concave, or conical. They are, however, projected from tubular cases, into which the animal can withdraw them at pleasure. They sometimes turn the same way, and sometimes different ways at the same time.

All the actions of this creature indicate great sagacity and quickness of sensation.

Dr. Shaw, in his *Naturalist's Miscellany*, informs us, that the *Convallarian Vorticella* is frequently found on the stalks of the lemna or duckweed, as well as on those of other aquatic plants, and that it is one of the most elegant of the whole tribe. This animalcule is remarkable for the very sudden and starting manner in which it performs its motions; contracting its stem rapidly, and in a kind of convulsive manner, into a spiral form, and again gradually extending it to its former length.

OF THE VIBRIO TRIBE.

In this numerous tribe, the animals (nearly invisible to the naked eye) are of a simple, round, and elongated form. Several of them are found in vegetable infusions, and some in stagnant water: a few have been discovered in putrid sea-water, one in vinegar, and two in paste and infusions of grain.

THE EELS IN PASTE*, AND IN BLIGHTED WHEAT†.

From the general round and elongated form of these

* DESCRIPTION. These animalculæ are filiform, with a dark shield on the back, surrounded with a white ring. The head is obtuse.

SYNONYMS. *Vibrio glutinis*. Linn.—*L'Anguille de la Colle*. Cuvier.

* DESCRIPTION. The animals of this species taper towards each end, and are pellucid.

SYNONYMS. *Vibrio anguillula*. Linn.—*Vibrion anguille*. Bosc.

animalculæ, all the microscopical writers have been led to distinguish them by the appellation of Eels, although even the most gigantic individuals are seldom the tenth of an inch in length.

In order to procure those which are found in paste, the following simple process is recommended: boil some flour in water, adding to it a few drops of vinegar; put this into a coarse cloth, and bury it in an earthen pot, which has a hole in the bottom, and which is partly filled with earth: the pot is then to be exposed to the heat of the sun in summer, or kept in a warm place in the winter, for ten or twelve days, at the end of which time, if examined with a glass, it will be seen to contain a great abundance of these animalcules, which move about in every direction, with wonderful strength and rapidity.

If, from a small quantity of the paste diluted with water, one of the Eels be separated, and removed into a drop of water ready prepared on a separate glass, and there be cut asunder with a lancet or very sharp penknife, the mode in which the young-ones come to life may at any time be observed. Several oval bodies will be seen to issue from the wound. These are the offspring, in different stages of maturity, each coiled up and enclosed in its proper membrane. The largest and most forward of the group break through this delicate integument, unfold themselves, and wriggle nimbly about in the water. Others escape from their confinement, uncoil themselves, and move more slowly; and those which are least mature, continue entirely without motion. More than a hundred have thus been observed to issue from a single individual. This circumstance will readily account for their very sudden and prodigious increase.

It is an extremely singular circumstance, that in the latter part of the year, and during winter, these Eels are oviparous, whilst at other seasons they produce living offspring.

The *Eels of blighted Wheat* are found in those ears, the grains of which appear blackish, as if scorched, and the inside of which contains a soft, white substance. If these grains be soaked in water for a few hours, a great number of the animalculæ will be found, some of them sufficiently large to be visible without the aid of magnifying powers.

They are oviparous; and the eggs, when at full growth, are nearly of a cylindrical shape, with both the ends rounded. These issue from two little protuberances at the posterior extremity of the body. In the microscope, two generations may often be seen at the same time in the same animal, some of them almost in a state of maturity, and others small.

In blighted grains of wheat, which have been kept dry even for years, these animalculæ have been found after a soaking of ten or twelve hours in water.

THE PROTEAN VIBRIO*.

This is a species which has derived its name from its very singular power of assuming different shapes, so as sometimes with difficulty to be distinguished for the same animal. When water, in which any vegetable has been infused, or in which any animal substance is preserved, has stood undisturbed for some days, a slimy substance will be found on the sides of the vessel, some of which, if viewed in a microscope, will be found to contain, among several other animalcules, the Proteus. It is pellucid and gelatinous; and generally swims about, with a long neck and bulbous body, and with great vivacity. Sometimes it stops for a minute or two, and stretches itself out, apparently in search of prey. When alarmed, it immediately draws in its neck, becomes more

* DESCRIPTION. In this minute animalcule, one of the extremities terminates in a sharp point.

SYNONYMS. *Vibrio Proteus*. Linn.—*Protée Tenace* (*Proteus tenax*.) Bosc.

opaque, and moves sluggishly. It will then, perhaps, instead of its former long neck, push out a kind of wheel machinery, the motions of which draw a current of water, and, along with this, probably its prey. Withdrawing the wheel, it will, sometimes, for several seconds, remain nearly motionless, as if weary; then, protruding its long neck, it will resume its former agility, or, instead, adopt in succession a multitude of different appearances.

OF THE VOLVOX TRIBE.

Nearly all the species of Volvox are invisible to the naked eye. They are simple, pellucid, and of spherical shape. One of the kinds is found in pure water, one in vegetable infusions, and others in water which has been kept in glass. The species hitherto ascertained, are only nine in number.

THE GLOBULAR VOLVOX*.

During the spring and summer months, these animalculæ are every where to be found in stagnant water; and in winter, they may be produced in water by an infusion of hempseed or hay. Sometimes they are sufficiently large to be visible by the naked eye. They move round, rolling over and over like a bowl, spinning like a top, or gliding along smoothly without turning at all. Sometimes their motions are very slow, and at other times quick and active. Occasionally they may be seen to turn rapidly round, as if upon an axis, without moving out of their places.

Under the microscope, their bodies seem to be covered with numerous globulets of different sizes. These

* DESCRIPTION. This species is spherical, membranaceous, and has upon its body various-sized globulets or homogeneous molecules. It is of a greenish or yellowish colour.

SYNONYMS. Volvox Globator. Linn.—Volvox globuleux. Bosc.—Le Volvoce sphérique. Cuvier.

appear to contain the young-ones, for, when they are in a proper state of maturity, the exterior membrane bursts open, and the young-ones pass through the fissure: shortly after this the parent animalculæ die and melt away.

The globulets, while in the body of the parent, contain other globulets, and these again others; so that it may, with propriety, be said, that these animalculæ bear children, grand-children, and great grand-children all at the same time.

THE BUBBLE VOLVOX*.

I shall conclude this work, with La Martiniere's description of *Volvox Bulla*, a species of animals nearly the most simple of any that have yet come to our knowledge. "They consist (he says) only of oval bodies, similar in shape to soap-bubbles, arranged in parties of three, five, six, and nine: among them are also some solitary ones. These collections of globules, being put into a glass filled with sea-water, described a rapid circle round the glass by a common movement, to which each individual contributed by the simple compression of the sides of its body, probably the effect of the reaction of the air with which they were filled. It is not, however, easy to conceive how these distinct animals (for they may be readily separated without deranging their economy) are capable of concurring in a common motion. These considerations, together with the form of the animal, recalled to my mind, with much satisfaction, the ingenious system of M. de Buffon; and I endeavoured to persuade myself, that I was about to witness one of the most wonderful phenomena of nature, supposing that these molecules, which were now employed in increasing or diminishing their number, or performing their revolutions in the glass, would soon assume the

* DESCRIPTION. This animalcule is scarcely visible to the naked eye. It is of a somewhat oval shape, and membranaceous.

SYNONYM. *Volvox Bulla*. *Linnaeus*.

form of a new animal, of which they were the living materials. My impatience led me to detach two from the most numerous group, imagining that this number might perhaps be more favourable to the expected metamorphosis. I was, however, mistaken. These I examined with more attention than the rest, and the following account is of their proceedings alone. Like two strong and active wrestlers, they immediately rushed together, and attacked each other on every side: sometimes one would dive, leaving its adversary at the surface of the water; one would describe a circular movement, while the other remained at rest in the centre: their motions at length became so rapid, as no longer to allow me to distinguish the one from the other. Having quitted them for a short time, on my return I found them reunited as before, and amicably moving round the edge of the glass by their common exertions."

Quelle magnificence dans le plan de la creation terrestre!
 quelle grandeur! quelle profusion!
 quelle complaisance à organiser la matière,
 et à multiplier les êtres sentants!
 Nous voyons les animaux répandus
 sur toute la surface de la terre,
 dans toute l'étendue des eaux,
 et jusques dans les vastes contours de l'atmosphère.
 La Mitte, comme l'Elephant;
 le Puceron, comme l'Autruche;
 le Vibrio comme la Baleine, ne sont qu'un compose
 d'animaux;
 toutes leurs liqueurs en fournissent;
 tous leurs vaisseaux en sont semés!

Were ev'ry falt'ring tongue of man,
 Almighty Father! silent in thy praise,
 Thy works themselves would raise a general voice;
 Even in the depth of solitary woods,
 By human foot untrod, proclaim thy power.

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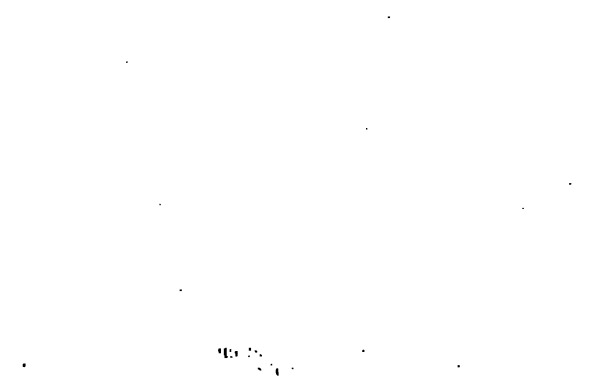
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